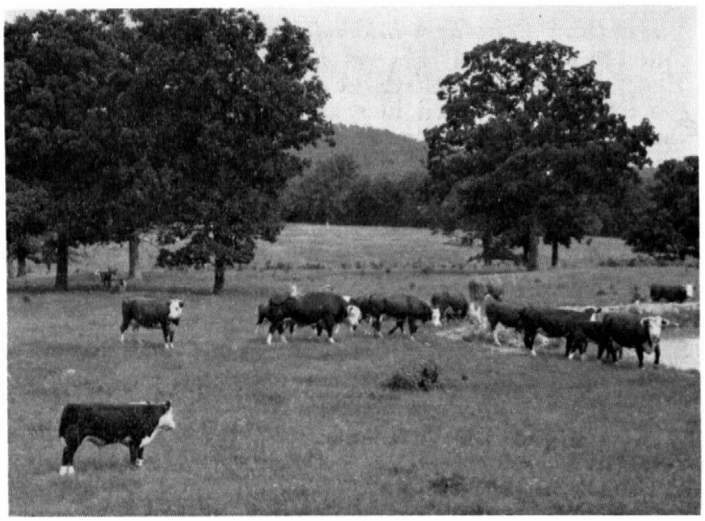
Series 1961, No. 31

Issued September 1965

SOIL SURVEY

Adair County, Oklahoma



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
in cooperation with
OKLAHOMA AGRICULTURAL EXPERIMENT STATION

HOW TO USE THIS SOIL SURVEY REPORT

THIS SOIL SURVEY of Adair County, Oklahoma, will serve several groups of readers. It will help farmers and ranchers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; aid foresters in managing woodland; add to soil scientists' knowledge of soils; and help bankers, prospective buyers, and others in appraising a farm or other tract.

Locating the Soils

At the back of this report is an index map and a soil map consisting of many sheets. On the index map are rectangles numbered to correspond to the sheets of the soil map so that the sheet showing any area can be located easily. On each map sheet, the soil boundaries are outlined and there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside the area and a pointer shows where it belongs. For example, an area on the map has the symbol BsF. The legend for the set of maps shows that this symbol identifies Bodine stony silt loam, steep. That soil and all others mapped in the county are described in the section "Descriptions of the Soils."

Finding Information

The "Guide to Mapping Units, Capability Units, and Range Sites" at the back of this report leads to much that is written about each soil. In this guide the soils are listed in the alphabetic order of their map symbols. The guide also gives for each soil the page numbers of its description and of its capability unit and range site. In the headnote of the guide are the page numbers of the acreage table, the table for estimated yields, the table showing the suitability of some soils for shortleaf pine, and tables that contain information significant to engineering.

Farmers and those who work with farmers can learn about the soils on a farm by reading the description of each soil and of its capability unit and other groupings. A convenient way of doing this is to turn to the soil map and list the soil symbols of the soils on a farm, and then to use the "Guide to Mapping Units, Capability Units, and Range Sites" in finding the pages where each soil and its groupings are described.

Foresters and others interested in woodland can refer to the subsection "Use of Soils for Woodland." In that subsection the forests of the county and the suitability of some soils for woodland are discussed.

Game managers, sportsmen, and others concerned with wildlife will find information about the main kinds of wildlife and their food and cover in the subsection "Use of Soils for Wildlife."

Ranchers and others interested in range will find the subsection "Management of Soils for Range" helpful. In that subsection the soils of the county are placed in groups according to their suitability as rangeland, and the management of each group is discussed.

Engineers and builders will find in the subsection "Engineering Uses of Soils" tables that (1) list test data for selected soils; (2) give engineering descriptions of the soils in the county; (3) rate the soils according to their suitability for some engineering work; and (4) name soil features that affect engineering practices and structures.

Scientists and others who are interested can read about how the soils were formed and how they were classified in the section "Formation, Classification, and Morphology of Soils."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest.

Newcomers in Adair County will be especially interested in the section "General Soil Map," where broad patterns of soil are described. They may also be interested in the section "General Nature of the County," which gives additional information about the county.

* * * * *

Fieldwork for this survey was completed in 1961. Unless otherwise indicated, all statements in the report refer to conditions in the county at the time the survey was in progress. The soil survey of Adair County was made as part of the technical assistance furnished by the Soil Conservation Service to the Adair County Soil Conservation District.

Cover Picture: Beef cattle and strawberries are important products of Adair County. Cattle are grazing on bermudagrass and clover on land formerly in trees and brush; strawberries are on Bodine very cherty silt loam.

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Issued September 1965

SOIL SURVEY OF ADAIR COUNTY, OKLAHOMA

BY PETER WARTH AND DOCK J. POLONE, SOIL CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE OKLAHOMA AGRICULTURAL EXPERIMENT STATION

ADAIR COUNTY is in the mountainous east-central part of Oklahoma (fig. 1). It is bordered on the north by Delaware County, on the west by Cherokee County, on the south by Sequoyah County, and on the east by the State of Arkansas. It has an area of 569 square miles, or 364,160 acres. Stilwell, the county seat, is in the east-central part of the county, 7 miles west of the Arkansas State line.

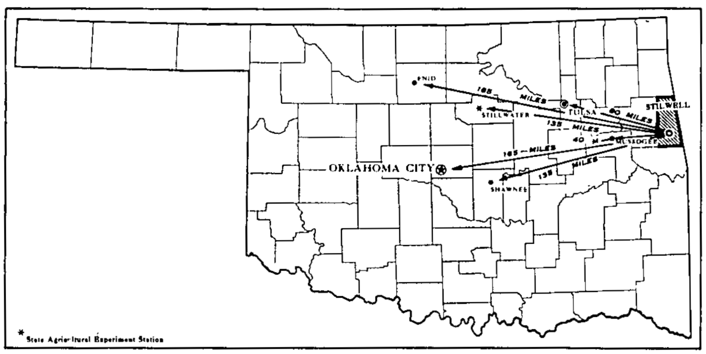

Figure 1.—**Location of Adair County in Oklahoma.**

Agriculture and related services are important in Adair County. The chief income is from the sale of livestock and livestock products. Ranking foremost among the horticultural crops are strawberries (*2*),[1] green beans, apples, and peaches; but other vegetables and fruits are also produced in the area. Corn, small grain, grain sorghum, and improved grasses and legumes for hay are grown mostly as feed for livestock. About two-thirds of the total acreage is in woodland, and the sale of forest products is now an important supplement to farm income.

General Nature of the County

In this section information is provided for those who wish to get a general idea of the county.

The agriculture and industry, as well as the cultural and natural features in the county, are briefly discussed.

[1] Italic numbers in parentheses refer to Literature Cited, p. 60.

Agriculture

In the following pages the early agriculture, present trends in agriculture, the number and size of farms, farm tenure, crops, and livestock are discussed. Unless otherwise stated, the statistics used are from reports published by the U.S. Bureau of the Census.

Early agriculture

The first settlers in Adair County were Cherokee Indians, shortly after 1800. They found thick forests of pine and oak and a few grassy savannahs and prairielike openings, which were in the broad, sloping valleys in the northern and central parts.

Many of the crops that the Cherokees had grown in their old homeland in the South were tried in their new one. Peach trees and some tobacco were planted, but the principal crops were corn and wheat. At first the acreage cultivated was small, because each field had to be cleared and fenced to keep out the cattle, horses, and hogs that grazed on the free range. The corn was ground into meal at an old water-powered gristmill, built near Bitting Springs in 1844. As it was the chief wheat-raising and milling center, Westville was locally called Breadtown (*6*).

After the Kansas City Southern Railroad was built, timber became an important source of cash income. From 1910 to mid 1930, some cotton was grown. Also, during this period the first commercial orchards were planted; and strawberries, blackberries, tomatoes, and green beans were grown for sale. Because the Indians had not acquired a taste for dairy products, dairying started slowly. It was not until 1940 that dairying became important in the county.

Trends in agriculture [2]

In the period 1910–50, the number of farms in Adair County increased from 1,235 to more than 1,919. Then the trend was reversed and the number dropped. The total acreage in farms rose from 124,176 acres in 1910 to 169,352 in 1960. The percentage of land in farms rose from 33.2 to 46.5 in the same period.

[2] STEWART JESSEE, economist, Soil Conservation Service, assisted in writing this subsection.

NUMBER AND SIZE OF FARMS

Before 1950 the average size farm was 100 acres or less. By 1959 the average size had increased to 137.6 acres. The number of farms containing 260 acres or more, however, increased from 104 in 1950 to 165 in 1960. On the basis of a 20 percent sample, the 1959 census lists the number and size of farms as follows:

	Number of farms
Less than 50 acres	398
50 to 99 acres	273
100 to 179 acres	280
180 to 259 acres	115
260 to 499 acres	120
500 to 999 acres	37
1,000 or more acres	8

In 1962 about 97 percent of the farms in Adair County had electric power provided by the Ozark Electric Cooperative.

FARM TENURE

More than 50 percent of the farms were operated by owners during the period 1910–40; tenants operated 38 to 46 percent. The trend in proportion to tenants has been significantly downward since 1940. The 1959 census showed that about 12 percent of the farms were operated by tenants. It lists farm tenure as follows:

	Number of farms
Full owners	934
Part owners	152
Managers	1
Tenants	144

CROPS

The acreage of selected crops in Adair County in 1939, 1949, and 1959 is shown in table 1.

TABLE 1.—*Acreage of selected crops in stated years*

Crops	1939	1949	1959
Wheat	3, 085	651	503
Oats	4, 171	2, 414	783
Barley	949	39	258
Corn	15, 184	8, 912	2, 428
Cotton	138	8	0
Sorghum	2, 636	202	699
Hay, total	9, 555	16, 183	14, 104
Small grains cut for hay	3, 929	2, 418	2, 139
Lespedeza	1, 363	11, 057	4, 692
Alfalfa	1, 026	338	342
Native hay	479	634	1, 143
Clover and clover-grass mixtures	772	598	2, 124
Other hay cut	1, 986	1, 138	3, 664
Vegetables harvested for sale	516	1, 456	1, 335
Strawberries	180	617	719

Since 1939 the acreage of wheat and cotton has steadily declined, whereas the acreage of hay has remained comparatively unchanged. Strawberries are one of the most economically important crops, as shown by the marked increase in acreage. Green beans, okra, and other vegetable and truck crops are also valuable cash crops.

LIVESTOCK

The number of livestock on farms in Adair County in 1940, 1950, and 1959 are listed in table 2. In the 1910–59 period, the number of cattle increased from 7,660 to 22,381.

TABLE 2.—*Livestock on farms in stated years*

Livestock	1940	1950	1959
	Number	*Number*	*Number*
Cattle and calves	14, 278	20, 011	22, 381
Milk cows	[1] 4, 333	6, 578	3, 906
Hogs and pigs	8, 965	11, 363	7, 747
Sheep and lambs	1, 366	2, 136	1, 757
Horses and mules	3, 970	3, 797	1, 161
Chickens 4 months old and over	71, 932	70, 971	37, 321
Chickens sold [2]	35, 694	320, 896	1, 030, 841

[1] One year earlier than year given at head of column.
[2] Includes broilers.

In the past 50 years sale of livestock and livestock products has been the principal source of agricultural income in Adair County. Most of the beef cattle are kept as breeding herds, from which stocker calves are marketed. The number of dairy cattle nearly doubled between 1910 and 1950, but there has been a steady decline since. The number of hogs also has dropped substantially since 1950.

There has been a tremendous increase in the county's poultry industry in the past 10 years, particularly in production of broilers. In 1959 more than a million chickens were marketed by local poultrymen.

Industry

Fruits, berries, and vegetables grown locally are processed by four canning companies in the county. The largest is in Stilwell and has nationwide distribution. A modern fruit-storage plant is now available to commercial orchardists. The charcoal plant at Baron is one of the largest plants west of the Mississippi River. Also in the county are many poultry processing plants and a large yard from which crossties are shipped.

The lack of an adequate supply of water has hindered expansion of the industries now in the county and prevented the establishment of new plants. The organization of the Sallisaw Creek Conservancy District, however, has overcome this deterrent to county growth and development. Under an approved plan for the district, a large reservoir will be constructed near Stilwell. This reservoir not only will supplement the present municipal and industrial supply, but also will provide sufficient water for the expansion of present industries and for new ones.

A reliable supply of water is also directly related to the successful development of the recreational facilities now being planned in this scenic area.

History

Many American Indian tribes favored the area that made up Adair County because of its superior hunting and fishing. The western Cherokees, however, had become a predominant tribe in the area by 1808. These were Indians who had left voluntarily the main tribe and their homes in Georgia, Tennessee, and North Carolina to migrate west. More than 7,000 already had settled in Arkansas between the Arkansas and the White Rivers

before their title to the land was confirmed by the United States by the treaty of 1817 (*3*).

A new treaty 11 years later gave them in exchange for their homes in Arkansas a grant of 7 million acres, part of which extended west to the 100th meridian. Many of the western Cherokees that were forced to move into the Indian Territory elected to settle just across the border in the rugged, mountainous area in which they had hunted and fished, and which became the last Cherokee stronghold. In 1839 this area, as part of the Flint and Going Snake Districts, belonged to the old Cherokee Nation (*8*). In 1907 when the Indian Territory was admitted to the Union as the State of Oklahoma, this area was included as a county and named Adair in honor of a prominent Cherokee jurist and educator.

Population

Four major periods in the county's history have affected its growth and population. The first was the moving of the Western Cherokees into the Indian Territory. The second was when these "Old Settlers," were joined by the Eastern Cherokees, or "Immigrants," in 1838. Only the most daring white people, mainly those of Irish descent, settled in the area ruled by the Cherokees. But after the construction of the railroad, many other white families moved in from Arkansas, Missouri, Tennessee, and Georgia. During the years of drought and financial depression, many who had gone west returned.

In comparison with most agricultural counties, Adair shows a remarkably low percentage of loss in population. Love of their homeland and close family ties are characteristic of the people, most of whom are the native-born descendants of families who first settled in the area. Approximately 91 percent of those living in southern Adair County are of Cherokee descent. Also, the county has the largest concentration of Cherokee Indians in the United States. In the 1959 census the population of the county was 13,063. The greatest concentration was in the incorporated towns of Stilwell, Westville, and Watts.

Transportation

The main line of the Kansas City Southern Railroad crosses the county in a north-south direction and serves Stilwell and Westville. Two buslines and several trucklines also serve the county. U.S. Highway No. 59 extends in a north-south direction on the eastern side of the county, and U.S. Highway No. 62 crosses the north-central part of the county in an east-west direction. The county also has two State routes and an excellent network of farm-to-market county roads. Except in extremely bad weather, the county roads provide easy access to all farms.

Community Facilities

Churches and schools have been important in the history and development of Adair County. The Baptist Mission near Westville was opened by the Baptist Church in 1839. The first periodical printed in the Indian Territory was the Cherokee Messenger, published at the mission in 1844. The First Methodist Church in Stilwell is one of the oldest churches in Oklahoma and has more than 122 years of continuous history. Today, many denominations are represented by churches in the towns and throughout the county.

The Cherokees have always stressed education. Their early schools in the Indian Territory were taught by headmasters and teachers from New England colleges, who were far better qualified than most schoolteachers in the West. At costs that represented extreme sacrifice, the older students were sent to Cane Hill Seminary, to Fayetteville in Arkansas, and to the Male Seminary and Female Seminary in Tahlequah. Tahlequah was the capital of the Cherokee Nation (*3*).

The county now has 26 rural schools. Thirteen buildings are new, and the rest have been modernized. Cave Springs, Stilwell, Watts, and Westville have independent school districts with high schools, junior high schools, and elementary schools. In teacher qualification and student scholastic achievement, Adair County schools rank in the upper 30 percent of schools in the State. The proportion of people in Adair County who have a college degree or some college or specialized training is among the highest for rural counties in the Nation.

The same intense desire that prompted the people to provide good schools also prompted them to construct a modern hospital and nursing facilities. The Stilwell Municipal Hospital, twice enlarged, is accredited by the American Hospital Association. Nursing homes are also located in Stilwell and Westville. Westville has organized a city library and constructed a medical clinic.

Climate

The climate of Adair County is mild and agreeable. The average annual temperature is 59.5° F. The frost-free season of 200 days extends from about April 10 to about October 27. Risk of damaging frost, however, lessens after March 31, and the first killing frost is often delayed until the first week in November. The probability of the first and last freeze is shown in table 3.

Normally, rainfall is well distributed throughout the year. The monthly and annual precipitation and temperature are shown in table 4. The average annual precipitation is 43.64 inches; the heaviest rains fall in spring and in autumn. Prolonged wet or dry periods are rare. Only 2 wet years and 2 dry years have been recorded. Heavy rains and short periods of drought are more common. Too much rain early in May affects the quality and yield of the first picking of strawberries (*2, 4*). Not so harmful, however, are the periods of dry weather in midsummer. Growth of vegetation then is complete, and the dry, sunny days add quality and flavor to fruits and vegetables (*5*). Fall-sown grain and winter pasture are affected by short dry periods, but rains early in spring bring quick recovery.

Winter is characterized by cloudiness, drizzle, and brief periods of cold temperature broken by periods of moderate temperature. Existing data show an average annual snowfall of 5.7 inches, which is comparable to snowfall in the northern mountain area of the State of Georgia (*12, 13*). According to farm records, peach and apple trees south of Stilwell have been damaged only twice by ice and glaze, or coating of ice, in the past 34 years.

TABLE 3.—*Probabilities of last freezing temperatures in spring and first in fall, Adair County*

[Data for northern part (N) from Watts, Okla.; data for southern part (S) interpolated from Watts and Tahlequah, Okla., and from Fayetteville and Fort Smith, Ark.]

Probability	Dates for given probability and temperature				
	16° F.	20° F.	24° F.	28° F.	32° F.
Spring:					
1 year in 10 later than	(N) March 9	(N) March 25	(N) April 11	(N) April 23	(N) May 3.
	(S) March 1	(S) March 16	(S) March 29	(S) April 12	(S) April 21.
2 years in 10 later than	(N) March 2	(N) March 19	(N) April 4	(N) April 17	(N) April 28.
	(S) February 22.	(S) March 10	(S) March 22	(S) April 6	(S) April 16.
5 years in 10 later than	(N) February 17.	(N) March 7	(N) March 23	(N) April 6	(N) April 17.
	(S) February 9	(S) February 26.	(S) March 10	(S) March 26	(S) April 5.
Fall:					
1 year in 10 earlier than	(N) November 20.	(N) November 5.	(N) October 24	(N) October 16	(N) October 6.
	(S) November 22.	(S) November 12.	(S) November 3.	(S) October 26	(S) October 14.
2 years in 10 earlier than	(N) November 27.	(N) November 12.	(N) October 30	(N) October 21	(N) October 12.
	(S) November 29.	(S) November 19.	(S) November 9.	(S) October 31	(S) October 20.
5 years in 10 earlier than	(N) December 9.	(N) November 25.	(N) November 11.	(N) October 31	(N) October 22.
	(S) December 11.	(S) December 2.	(S) November 21.	(S) November 10.	(S) October 30.

TABLE 4.—*Temperature and precipitation*

[Data for 1931 to August 1954 from Watts, Oklahoma; data for September 1954 to 1960 from Siloam Springs, Arkansas. Dashes indicate that data do not apply]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	2 years in 10 will have at least 4 days with—		Average total	1 year in 10 will have—		Days with snow cover 1 inch or more	Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
	° F	*° F*	*° F*	*° F*	*Inches*	*Inches*	*Inches*	*Number*	*Inches*
January	50	26	68	8	1.95	0.5	3.2	3	3
February	54	29	71	15	2.88	.8	5.3	2	2
March	61	36	77	18	3.58	.8	7.6	2	2
April	72	46	84	31	4.81	2.3	9.2	1	1
May	79	55	88	42	5.84	2.3	13.4	0	----------
June	87	61	97	51	4.78	.4	8.7	0	----------
July	93	66	101	59	3.18	.1	6.5	0	----------
August	93	66	104	55	2.98	.5	5.2	0	----------
September	87	58	98	43	3.94	.4	8.1	0	----------
October	76	47	90	32	3.86	1.0	8.3	0	----------
November	61	35	76	19	3.28	.3	5.8	1	3
December	53	29	69	16	2.56	.5	4.5	3	1
Year	72	46	[1] 103	[2] 1	43.64	32.2	57.9	12	2

[1] Average annual highest maximum. [2] Average annual lowest minimum.

Geology [3]

Physiographic setting.—Adair County is on the Ozark Plateau. The plateau has the form of a broad, asymmetrical dome and occupies approximately 40,000 square miles in Missouri, Arkansas, and Oklahoma. The Ozark Plateau is divided into three physiographic areas—the Salem Plateau, the Springfield Structural Plain, and the Boston Mountains. Only two physiographic areas, however, are represented in Adair County. The northern part of the county is in the Springfield Structural Plain, and the southern part is in the Boston Mountains.

The Springfield Plain is maturely dissected and is underlain by chert and limestone of Mississippian age (fig. 2). The deep, V-shaped valleys have cut into rocks of Ordovician age, and the isolated outliers that rise above the general upland surface are capped by flat-lying sandstone of Pennsylvanian age. The Boston Mountains physiographic area forms a narrow belt of rugged topography that is characterized by a series of fault blocks that have a northeast trend and have steep escarpment faces and gentle dip slopes. Atoka sandstone of Pennsylvanian age forms the surface rocks. Stream dissection has cut deep valleys through the ridges, and several major drainage lines are parallel to the fault trends.

The county is in the drainage basin of the Arkansas River. The northern part is drained by the Illinois River, and Barren Fork, Evansville, and Caney Creeks; the southern part by the south-flowing Sallisaw Creek and by Little Lee Creek.

Rock sequence.—Rocks exposed at the surface range from the Cotter dolomite of Early Ordovician age to the Atoka sandstone of Middle Pennsylvanian age. In Adair County these rocks are overlain by terrace and alluvial deposits of Quaternary age.

The Cotter formation, exposed only along the Illinois River in the northern part of the county, consists of a white to tan dolomite with minor amounts of sandstone, chert, and intraformational conglomerate. The Cotter formation is overlain unconformably by the Burgen formation, also of Ordovician age. It is gray to yellow, loosely cemented, friable sandstone, which reaches a thickness of 100 feet along the Illinois River. The Tyner formation, another Ordovician member, is named for exposures along Tyner Creek. It consists of bluish-green, fissile shale; brown, heavy-bedded dolomite; and thin-bedded dolomitic sandstone. Thickness ranges from 0 in the northern part of the county to 90 feet near Proctor. The Tyner is succeeded by the overlying Fite limestone, 8 to 10 feet thick, which is a light-gray, compact, lithographic rock. The overlying Fernvale member is a massive-bedded, coarsely crystalline, fossiliferous limestone that has a maximum thickness of 12 feet.

The Silurian age is represented by the St. Clair formation, a white to pink, medium to coarsely crystalline, massive-bedded limestone, which is exposed along the Lyons fault, T. 14, N., R. 24 E. Its thickness reaches 80 feet; the basal part is concealed.

Ordovician, Silurian, and Devonian rocks are beveled northward by the Chattanooga formation of Late Devonian or Early Mississippian age. The Chattanooga formation contains the basal Sylamore sandstone member (0 to 18 feet thick) and the overlying Noel black shale member (0 to 50 feet thick).

The Mississippian rocks in ascending order are the St. Joe, Reeds Spring, and Keokuk formations of the Osage group; the Moorefield formation of the Meramec group; and the Hindsville, Fayetteville, and Pitkin formations of the Chester group.

The St. Joe formation consists of gray, medium- to heavy-bedded, finely crystalline limestone, a few feet thick, and olive-green, calcareous shale. The overlying Reeds Spring formation is composed of alternating beds of bluish-gray to tan chert. Thickness ranges from 50 to 100 feet or more. The succeeding Keokuk formation (60 to 175 feet thick) is a massive, white to grayish mottled, fossiliferous chert that contains irregular masses of bluish-gray, fine-grained limestone.

The Moorefield formation (0 to 35 feet thick) includes several sedimentary facies. In the lower part are glauconitic limestone, fine-grained, argillaceous limestone, and coarsely crystalline limestone; and in the upper part are calcareous siltstone and shale. The Moorefield rests unconformably on the Keokuk formation and is succeeded upward unconformably by the Hindsville formation.

The Hindsville formation is a gray, medium-bedded, medium crystalline, oolitic, fossiliferous, and slightly shaly limestone. Its thickness ranges from 0 to 50 feet. It is succeeded upward by the Fayetteville formation, which contains a sequence of black, fissile shale and thin limestone interbedded. Near Stilwell the Wedington sandstone (0 to 25 feet thick) occurs in the upper one-third of the shale member. The Fayetteville formation attains a maximum thickness of 165 feet on Bugger Mountain. The overlying Pitkin formation is a gray, compact, finely crystalline limestone ranging in thickness from 0 to 50 feet.

The Pitkin formation of the Upper Mississippian geologic column is beveled northward by pre-Pennsylvanian erosion and is overlapped by the Morrow group of Pennsylvanian age comprising the Hale and Bloyd formations. The Hale (50 to 135 feet thick) consists of grayish-brown, sandy limestone and cross-bedded, calcareous sandstone with thin strata of shale and conglomerate at the base. The overlying Bloyd formation is a sequence of gray to black, finely to coarsely crystalline, thick-bedded limestone and interbedded gray shale, which reaches a maximum thickness of 225 feet near Stilwell. Rocks of the Morrow group are truncated northward by the pre-Atokan unconformity. They are succeeded upward by the Atoka formation, which is a sequence of brown, heavy-bedded, iron-stained sandstone; brown to gray, micaceous siltstone; and brown to black, fissile shale. Its thickness, as exposed in the southern part of Adair County, exceeds 250 feet.

Terrace gravel and alluvium of Quaternary age are along the valley floors of Sallisaw Creek, Little Lee Creek, Evansville Creek, Caney Creek, Barren Fork, and the Illinois River. Upland terrace gravel covers a 2-square-mile area southwest of Baron along U.S. Highway No. 59.

[3] Dr. GEORGE G. HUFFMAN, University of Oklahoma, Norman, Okla., prepared this section.

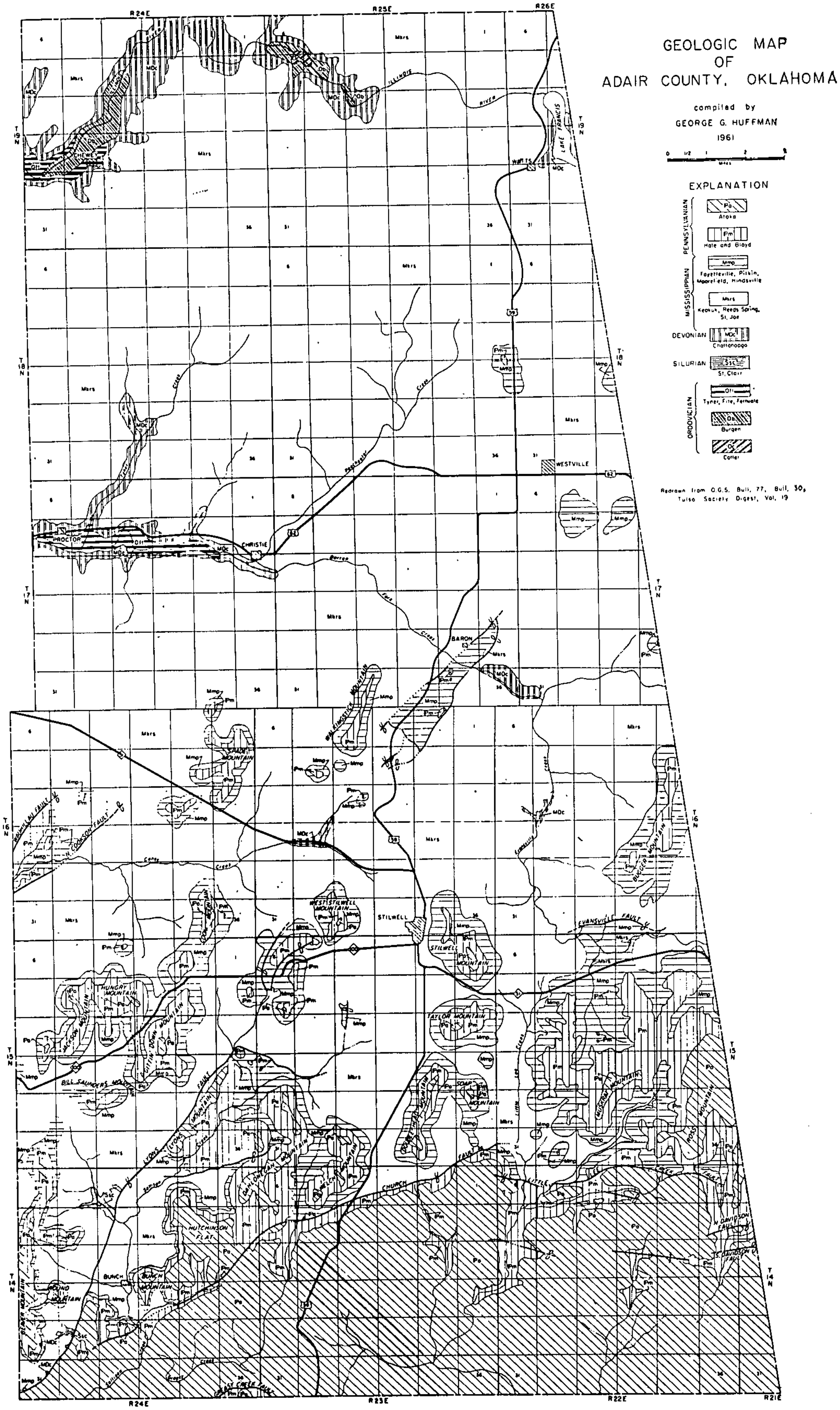

Figure 2.—Geologic map of Adair County. (Reproduced by permission of George G. Huffman, Univ. Okla.)

Structure.—Adair County is on the southern flank of the Ozark Plateau. Here formations that dip gently southward are interrupted by a series of normal faults that trend east to northeast. Steep dips ranging to 50 degrees occur in close proximity to the major faults. Faulting is most pronounced in the Boston Mountains.

The principal faults in Adair County are the Greasy Creek fault, Lyons fault, Church fault, North and South Davidson faults, Little Lee Creek fault, Wauhillau fault, North Cookson fault, Evansville fault, and the Baron Graben. These and several additional faults and minor folds are shown on the geologic map (see fig. 2).

Ground Water [4]

The ground-water conditions in Adair County have been studied only by reconnaissance methods. Most of the information contained in this discussion is from a map of the Oklahoma Geological Survey (*10*).

Adair County is underlain by two major ground-water provinces in which conditions differ appreciably. The first province covers the northern and central parts of the county. The depth to water is generally less than 100 feet. Yields of ground water vary widely but generally range from 50 to 500 gallons an hour. This amount is sufficient for domestic use and for limited irrigation in some places, but the supply of ground water for municipal use is inadequate. Most of the water in this province appears to occur in the cherty Keokuk formation, which is the upper member of the Boone group. In this region the cherty limestone does not filter the water, and bacterial contamination can be carried great distances. Probably small amounts of water are present in formations older than the Keokuk.

The second province covers the southern part of the county. Water occurs in rocks of the Atoka and Morrow formations. Although the depth to water is variable, water is commonly at a shallow depth. Yields of most wells are generally less than 50 gallons an hour but probably are sufficient for domestic use. In most places they are insufficient for municipal use or for irrigation.

Larger yields of ground water probably could be obtained by drilling into the highly fractured rock zones of both provinces. Ground water of some economic importance may also be present in the thicker alluvium along stream channels and on terraces. In most places, however, the alluvium along the tributaries is shallow, and little or no water would be obtained by drilling.

Some records of wells in Adair County were tabulated by the State Mineral Survey under the Works Progress Administration during the 1930's. These records were obtained in interviews with owners of wells. Although they are not necessarily accurate in all respects, the records give a general idea of the depth of wells in three different aquifers. The average depth for a selected number of wells in the different aquifers follows. Where the aquifer was limestone, the average depth of 47 wells checked was 44.6 feet; where it was chert, the average depth of 227 wells was 54.7 feet; and where it was sandstone, the average depth of 59 wells was 67.6 feet.

[4] Dr. WARD S. MOTTS, Oklahoma Geological Survey, assisted with this section.

744-927—65——2

How Soils Are Mapped and Classified

Soil scientists made this survey to learn what kinds of soils are in Adair County, where they are located, and how they can be used.

They went into the county knowing they likely would find many soils they had already seen, and perhaps some they had not. As they traveled over the county, they observed steepness, length, and shape of slopes; size and speed of streams; kinds of native plants or crops; kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by roots of plants.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. To use this report efficiently, it is necessary to know the kinds of groupings most used in a local soil classification.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Linker and Dickson, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that go with their behavior in the natural landscape. Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man.

Many soil series contain soils that differ in texture of their surface layer. According to such differences in texture, separations called soil types are made. Within a series, all the soils having a surface layer of the same texture belong to one soil type. Linker fine sandy loam and Linker loam are two soil types in the Linker series. The difference in texture of their surface layers is apparent from their names.

Some soil types vary so much in slope, degree of erosion, number and size of stones, or some other feature affecting their use, that practical suggestions about their management could not be made if they were shown on the soil map as one unit. Such soil types are divided into phases. The name of a soil phase indicates a feature that affects management. For example, Linker fine sandy loam, 1 to 5 percent slopes, is one of several phases of Linker fine sandy loam, a soil type that ranges from gently sloping to moderately sloping.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that greatly help in drawing soil boundaries accurately. The soil map in the back of this report was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning management of farms and fields, a mapping

unit is nearly equivalent to a soil type or a phase of a soil type. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil type or soil phase.

In preparing some detailed maps, the soil scientists have a problem of delineating areas where different kinds of soils are so intricately associated and so small in size that it is not practical to show them separately on the map. Therefore, they show this mixture of soils as one mapping unit and call it a soil complex. Ordinarily, a soil complex is named for the major kinds of soils in it. In other places two or more soils may be mapped together as an undifferentiated group if the differences between them are too small to justify separate recognition for the purpose of the soil survey. Also, on most soil maps, areas are shown that are so rocky, so shallow, or so frequently worked by wind and water that they scarcely can be called soils. These areas are shown on a soil map like other mapping units, but they are given descriptive names, such as Gravelly alluvial land.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soils in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soils. Yields under defined management are estimated for all the soils.

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in a way that it is readily useful to different groups of readers, among them farmers, ranchers, managers of woodland, engineers, and homeowners. Grouping soils that are similar in suitability for each specified use is the method of organization commonly used in the soil survey reports. The soil scientists set up trial groups based on the yield and practice tables and other data, and test these groups by further study and by consultation with farmers, agronomists, engineers, and others. Then, the scientists adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General Soil Map

As one travels throughout Adair County, distinct differences in the landscape can be seen. Some differences are in the shape, steepness, and length of slopes; in the course, depth, and speed of streams; in the width of the bordering valleys; in the kinds of wild plants; and in the kinds of agriculture. With these more obvious differences there are other less easily noticed differences in the patterns of soil. The soils differ along with the other parts of the environment.

By drawing lines around the different patterns of soil on a small map, one may obtain a general map that shows several main patterns of soil. Such a map is the colored general soil map in the back of this report. Each kind of pattern is called a soil association. Each association, as a rule, contains one or more major soils and several minor soils in a pattern that is characteristic though not strictly uniform. Each soil association is named for the major soil series in it, but soils of other series may be present. The pattern of soils is fairly uniform in each association, but the soils in any one association may be much alike or greatly different. Also, the same kind of soil may be present in more than one soil association but in a different pattern.

The general map showing patterns of soil is useful to those who want a general idea of the soils, who want to compare different parts of the county, or who want to locate large areas suitable for some particular kind of farming or other broad land use. The map is not sufficiently detailed to show accurately the kinds of soil on a single farm or other small tract.

The four soil associations in Adair County are discussed in the following pages.

1. Bodine-Dickson association: Cherty soils formed under trees, on uplands

The Bodine-Dickson soil association is the largest association in Adair County; it covers about 55 percent of the total area. This association is part of the Ozark Plateau, which extends westward from Missouri and Arkansas, and includes the northern and central parts of the county, as well as a few small, scattered areas in the southern part. In Adair County, the Ozark Plateau consists mostly of rough hills formed by the dissection of the cherty plateau. Many deep, narrow valleys and a few prairielike areas occur near Stilwell and Westville.

The soils generally overlie Boone chert (see fig. 3), but some of the deeper valleys have been cut into the lower lying shale and limestone. The ridgetops are generally more than 1,000 feet above sea level.

Bodine soils occupy the largest acreage in this soil association. They have mainly steep or very steep slopes, but in a few places they have gentle slopes. These soils are deep, but they have stones and chert on the surface and in the surface layer. The content of chert increases with increasing depth. About one-fourth of the acreage has been cleared, and the rest is in cutover woodland, in savannahs, or in brush.

Dickson soils are on the nearly level to gently sloping ridgetops. They are deep and loamy. In some places their surface layer is free of chert, but in others it contains as much as 25 percent, by volume, of chert fragments. About 80 percent of the acreage has been cleared of the original cover of hardwood and pine forests, and the rest is in cutover woodland, in savannahs, or in brush.

Lawrence silt loam is a minor soil in this association. It occurs in the nearly level areas or slight depressions on uplands adjacent to the Dickson soils. It has a clayey subsoil and is imperfectly drained. Water stands in the depressions after heavy rains. About 50 percent of the acreage has been cleared of the original forest cover, and the rest is in cutover woodland and brush. The soils in association 1 and their general location on the landscape are shown in figure 3.

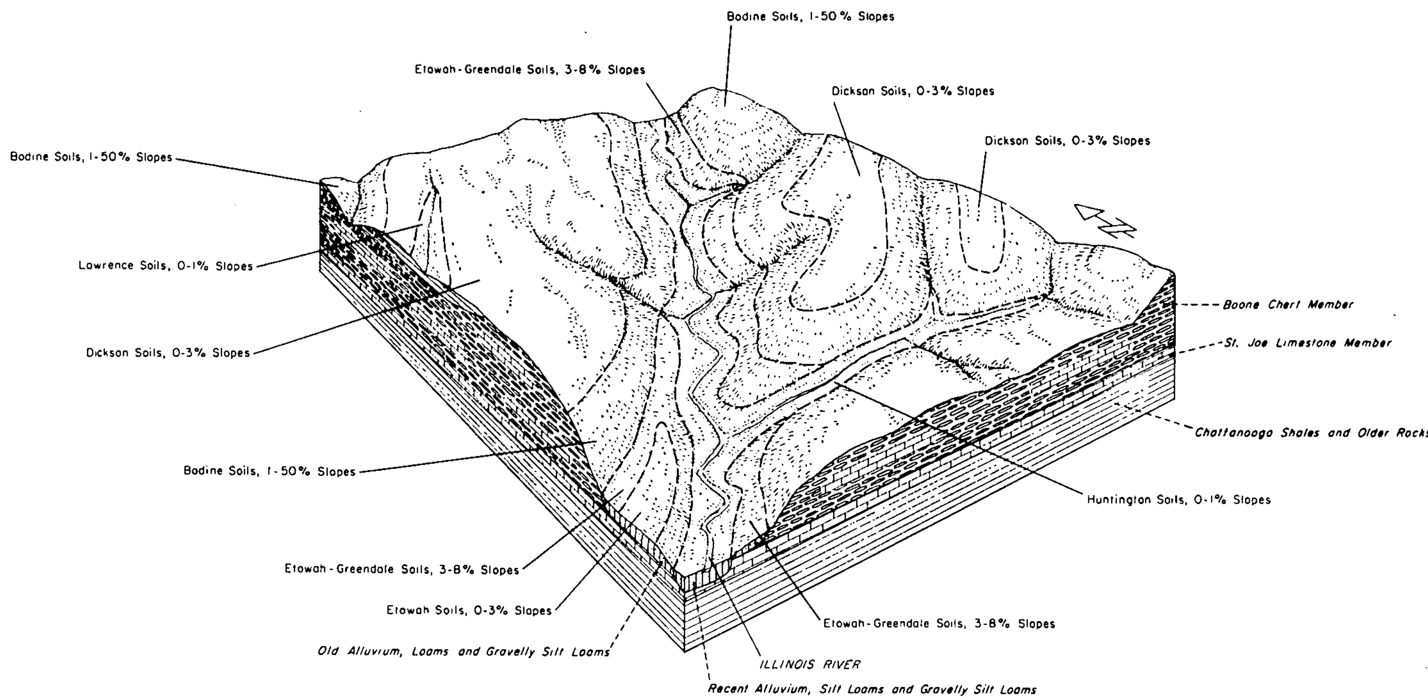

Figure 3.—**Soils in the Bodine-Dickson soil association and their general location in the landscape.**

If cleared of trees and brush, Bodine soils produce excellent yields of strawberries for about 5 years. After the yield of strawberries declines, the soils are seeded to tame pasture or range, or the field is invaded by brush, weeds, and inferior grasses. Shortleaf pine was part of the original cover and still thrives on these soils (*14*). Because Bodine soils are well drained to excessively drained, droughtiness is a problem during dry periods. Adequate plant cover and chertiness help to retard water erosion.

The cherty Dickson soils, which occur near the Bodine soils, are extensive. They are used mainly for strawberries, orchards, tame pasture, or range, but shortleaf pine also grows well. Some of the more cherty soils are difficult to cultivate because of the large volume of chert in their surface layer. Dickson silt loam is well suited to most crops grown locally and is a good soil for orchards and shortleaf pine.

2. Hector-Linker association: Soils on sandstone mountains

The Hector-Linker association is the second largest association in the county. It covers large areas that are mainly in the southern part, and scattered, smaller areas that are in the northeastern part. This association occupies about 26 percent of the total land area in the county and is part of the Boston Mountains physiographic area. This physiographic area includes most of the southern part of Adair County. Most of the area is rugged. The numerous flat-topped mountains have very steep slopes that descend into narrow valleys. The soils on the mountainsides and foot slopes were derived from sandstone and some shale; those in the valleys formed in stream deposits. The soils in association 2 and their general location on the landscape are shown in figure 4.

The Hector soils make up the largest part of this association. They have gentle to very steep slopes (fig. 5). They are shallow to very shallow, sandy or stony soils. The sandstone commonly crops out in the areas of very shallow soils. The very shallow, stony Hector soils with steep slopes are not suitable for cultivation, because of shallowness, stoniness, and droughtiness. These areas, however, have scenic value, and they may be used as habitats for wildlife. These soils can be used for woodland grazing or for minor production of timber. The original cover was a hardwood forest, but nearly all the acreage has been cut over. A small acreage of the very shallow, stony Hector soils, as well as about half the acreage of the shallow, less stony Hector soils, has been cleared of a secondary growth of trees and brush.

Most areas of the shallow Hector soils contain very small areas of Linker soils and, therefore, were mapped in a complex of Hector-Linker fine sandy loams. The soils in this complex have gentle or moderate slopes. About half the acreage has been cleared for orchards, strawberries, green beans, or tame pasture. Most areas are shallow and erosive, but they are productive when carefully managed. They are generally best suited to pasture or to range.

The Linker soils are on nearly level to moderately sloping mountaintops or foot slopes. These deep, fine sandy loam or loam soils usually have very little, if any, sandstone fragments in the surface layer. About 87 percent of their acreage is in orchards, cultivated crops, or tame pasture. The Linker soils are highly productive under good management.

3. Etowah-Huntington association: Soils on benches and flood plains

Soils of the Etowah-Huntington association occur along nearly all perennial and intermittent streams, along rivers, and in broad valleys throughout the county.

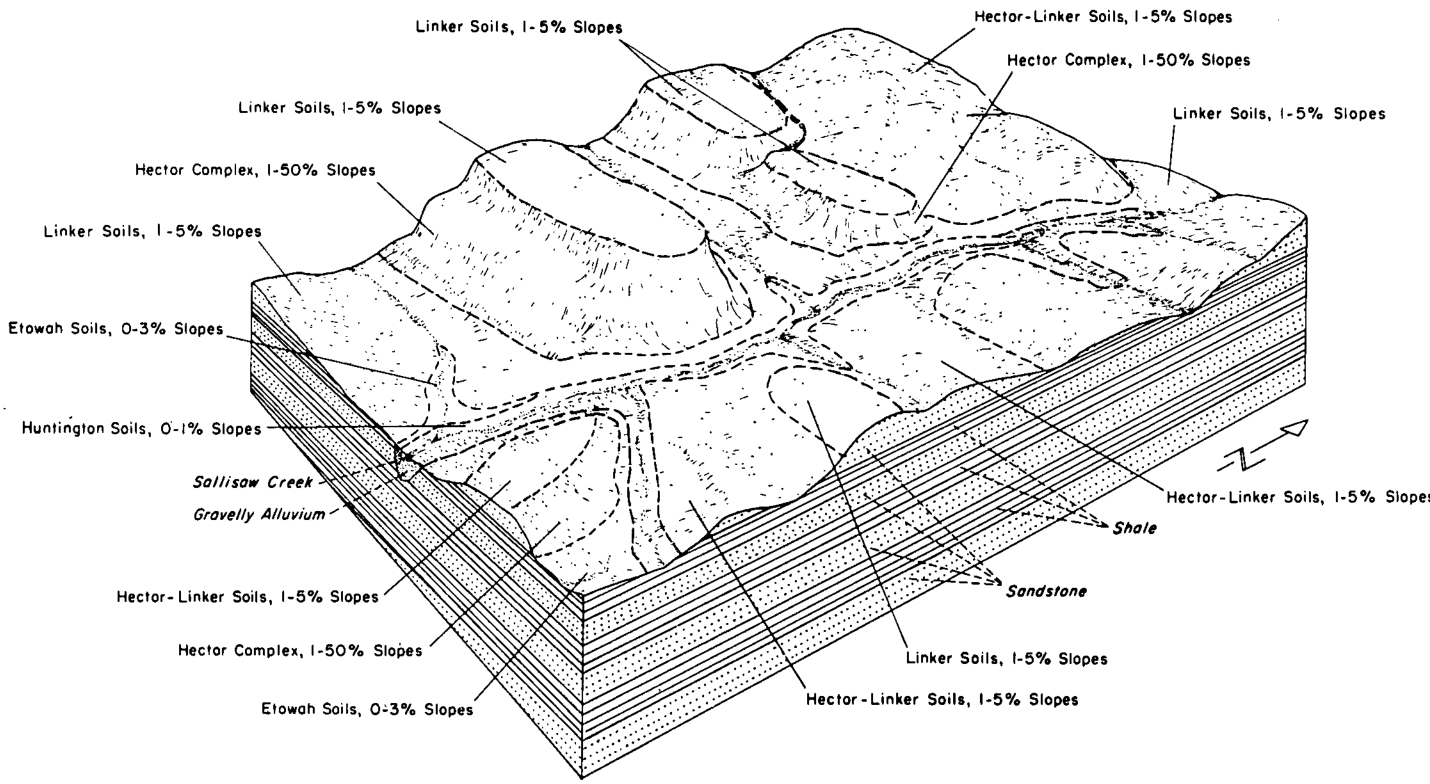

Figure 4.—**Soils in the Hector-Linker soil association and their general location in the landscape.**

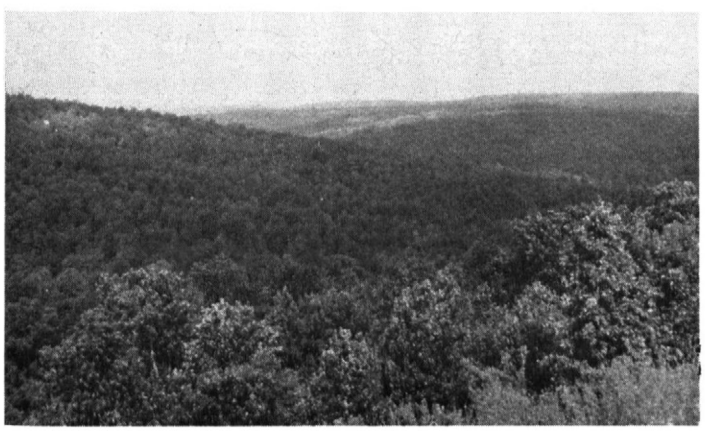

Figure 5.—**Typical view of soil association 2 in the sandstone mountain area of Adair County.**

The association covers about 16 percent of the total area. Most of the soils formed in alluvium, and they range from nearly level to strongly sloping.

The Etowah soils occupy the largest acreage in this association. They are mainly on nearly level to strongly sloping second bottoms and in some of the broader valleys. They are deep, loamy, or gravelly soils. The amount of gravel in the surface layer ranges from none to as much as 30 percent by volume.

In the more sloping areas, Greendale soils occur with the Etowah soils, and the two soils are so intermingled that separation on the soil map is not feasible. Such areas are mapped as Etowah and Greendale soils, 3 to 8 percent slopes. About 98 percent of the acreage of the Etowah soils and of the mapping unit of undifferentiated Etowah and Greendale soils has been cleared; the rest is in hardwoods and shortleaf pine.

The Huntington soils make up only a small total acreage in the county, but they are important agriculturally. They occur on nearly level first bottoms. They are deep, loamy, or gravelly soils. The amount of gravel in the surface layer may range from very little to as much as 50 percent by volume. About 80 percent of the acreage has been cleared of the original hardwood forest; the rest is in hardwoods and brush.

Gravelly alluvial land is a miscellaneous land type that makes up a sizable part of this association. It includes streambanks and channels. Most areas are largely gravel. This land type is frequently flooded, and the vegetation is mainly willows and water-tolerant hardwoods.

The very gravelly areas are used for browsing. Included in areas mapped as this land type are a few small areas of loamy and gravelly loam soils not suitable for cultivation but suitable for tame pasture.

Also in this association are minor areas of Taft and Osage soils. They are poorly drained soils on stream terraces or bottom lands. Most of their acreage is in tame pasture.

The Etowah soils, especially those that have nearly level or gentle slopes, are used for green beans, corn, and other crops grown locally. Where these soils are close to perennial streams, they are often irrigated; and, under good management, they are among the most productive soils in Adair County. Water erosion is the principal hazard on steeper slopes.

Most of the acreage of the Huntington soils is used for beans, corn, tame pasture, and other crops grown locally. Some fields along perennial streams are irrigated. These soils, however, are subject to occasional flooding, especially during periods of high rainfall.

4. Summit-Jay association: Soils formed under prairie grasses

The Summit-Jay soil association occupies the broader valleys of the Ozark Plateau, mainly near Stilwell and Westville. It is the smallest association in the county; it covers about 3 percent of the total area. Most of the association is nearly level to moderately sloping. In places, however, it is strongly sloping.

The Summit soils occupy the largest acreage in the association. They have nearly level to moderate slopes. They are deep and have a clayey subsoil. Their parent material is bluish-gray limestone. The original vegetation was native prairie grasses, but most areas are now cultivated or in tame pasture. The Summit soils are moderately well drained and, under good management, are highly productive.

The Jay soils occupy the next largest acreage in the association. They have nearly level or gentle slopes, are deep and loamy, and have a clayey subsoil. Their parent material is old loamy alluvium. Some low mounds occur. The original cover of the Jay soils was native prairie grasses. Nearly all of the acreage of Jay soils is now cultivated or in tame pasture. Jay soils are moderately well drained, and, under good management, are well suited to most crops grown locally.

The Sogn soils are of minor extent in this association. These soils formed from limestone. They have gentle to strong slopes, are very shallow, and are dark and clayey. Their moisture-storage capacity is limited by the small volume of soil material. Depth to bedrock ranges from 6 to 16 inches, and limestone outcrops are common. The original cover consisted of hardwood trees, brush, and patches of native grasses. The present vegetation is largely buckbrush, hackberry, and other woody shrubs and deciduous trees of poor quality. The Sogn soils are not suitable for cultivated crops. They are used mainly for browsing.

The Craig soils have about the same acreage in Adair County as the Sogn soils. They formed from cherty limestone and have gentle to moderate slopes. The original vegetation was native prairie grasses. Most areas have been cultivated and are now in tame pasture. Only about 400 acres are still in native grasses. The surface layer contains from 10 to 60 percent chert by volume; the amount increases with increasing depth. The chert makes tillage difficult and causes the soils to be somewhat excessively drained and droughty.

The Parsons and the Taloka soils are also of minor extent. They are deep, loamy soils that formed in clayey and silty alluvium over cherty limestone. They are in nearly level areas or slight depressions. Low mounds are common. The original vegetation was native prairie grasses, but nearly all areas have been cultivated and are now in tame pasture. A clayey subsoil causes water to stand on these soils after periods of heavy rainfall.

Descriptions of the Soils

The soil series (groups of soils) and single soils (mapping units) of Adair County are described in this section. The acreage and proportionate extent of each mapping unit are given in table 5.

TABLE 5.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Bodine stony silt loam, 5 to 15 percent slopes	16, 150	4. 4
Bodine stony silt loam, steep	88, 918	24. 4
Bodine very cherty silt loam, 1 to 8 percent slopes	54, 090	15. 0
Craig cherty silt loam, 1 to 5 percent slopes	1, 424	. 4
Dickson cherty silt loam, 0 to 3 percent slopes	26, 845	7. 4
Dickson silt loam, 1 to 3 percent slopes	13, 850	3. 8
Etowah gravelly silt loam, 1 to 3 percent slopes	12, 029	3. 3
Etowah silt loam, 0 to 1 percent slopes	1, 652	. 5
Etowah silt loam, 1 to 3 percent slopes	5, 655	1. 5
Etowah and Greendale soils, 3 to 8 percent slopes	18, 889	5. 3
Gravelly alluvial land	11, 228	3. 1
Hector complex	78, 113	21. 6
Hector-Linker fine sandy loams, 1 to 5 percent slopes	13, 079	3. 6
Huntington gravelly loam	3, 852	1. 1
Huntington silt loam	1, 722	. 5
Jay silt loam, 0 to 2 percent slopes	2, 358	. 6
Lawrence silt loam	909	. 3
Linker fine sandy loam, 1 to 5 percent slopes	2, 941	. 8
Linker fine sandy loam, 3 to 5 percent slopes, eroded	338	(1)
Linker loam, 3 to 5 percent slopes	1, 179	. 3
Linker loam, 3 to 5 percent slopes, eroded	474	. 1
Osage clay loam	459	. 1
Parsons silt loam, 0 to 1 percent slopes	533	. 1
Sogn soils	1, 746	. 5
Summit silty clay loam, 0 to 1 percent slopes	464	. 1
Summit silty clay loam, 1 to 3 percent slopes	1, 300	. 4
Summit silty clay loam, 3 to 5 percent slopes	482	. 1
Summit silty clay loam, 3 to 5 percent slopes, eroded	224	(1)
Taft silt loam	2, 510	. 6
Taloka silt loam, 0 to 1 percent slopes	258	(1)
Water	489	. 1
Total	364, 160	100. 0

[1] Less than 0.1 percent.

The procedure in this section is first to describe the soil series, and then the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read the description of that unit and also the description of the soil series to which it belongs. Gravelly alluvial land is a miscellaneous land type and does not belong to a soil series but, nevertheless, is listed in order with the soil series.

A soil symbol in parentheses follows the name of each mapping unit and identifies that unit on the detailed soil map. Listed at the end of the description of a mapping

unit are the capability unit and range site in which that kind of soil has been placed. The pages on which the capability unit is described can be found by referring to the "Guide to Mapping Units, Capability Units, and Range Sites" at the back of the report.

Soil scientists, teachers, engineers, and others who want more detailed information about soils should turn to the section "Formation, Classification, and Morphology of Soils." Many terms used in the soil descriptions and elsewhere in the report are defined in the Glossary.

Bodine Series

The Bodine series consists of very cherty or stony, strongly acid to medium acid, deep soils on uplands. These are the most extensive soils in Adair County. They occupy wide areas of the formerly timbered Ozark Plateau in the central and northern parts of the county. They were formed from cherty limestone. Slopes in most places are very steep, although some gentle slopes occur on ridgetops.

The surface layer is very cherty or stony silt loam that ranges from 6 to 12 inches in thickness. It is light brownish gray to dark brown in color and has weak, fine to medium, granular structure.

The more cherty subsoil is yellowish brown to strong brown in color and about 12 inches in thickness. It has weak, subangular blocky structure that cannot readily be determined because of the high content of chert. In some of the more stony soils, the surface layer is abruptly underlain by bedrock, and no subsoil layer occurs. The thickness of the subsoil layer varies from one place to another but averages about 12 inches. The silty clay loam part of the cherty subsoil occurs only in small amounts that accumulate in crevices of the chert.

The amount and size of the chert fragments vary widely throughout all layers, but the amount increases with increasing depth. Plant roots easily penetrate these cherty soils and in many places extend through crevices into the chert beds, which are 1 to 4 feet from the surface.

Bodine soils are well drained to excessively drained. They have rapid internal drainage and permeability and have low water-holding capacity.

Bodine soils contain more and larger chert fragments than the nearby Dickson soils and in most places are on steeper slopes.

The native vegetation on the Bodine soils consisted chiefly of hardwoods and some shortleaf pine. Nearly all the original forest has been cut over and has reverted to mixed woodland and brush. If cleared, many areas of less stony and less steep Bodine soils are well suited to strawberry culture. Their chertiness and rapid drainage are offset by the large amount of rainfall during spring. If these soils are cleared for strawberries, their acidity and lack of weedy grasses favor high production.

Bodine stony silt loam, steep (BsF).—This timbered soil occurs on steep slopes of the uplands that cover a wide area in the central and northern parts of the county. The slopes range from 20 to 50 percent, but in most places they are from 30 to 40 percent. Runoff is medium to rapid, but water erosion is retarded by stones, boulders, and rock outcrops.

The stony silt loam surface layer varies in thickness, and in most places it is not more than 6 or 7 inches thick at the top of slopes. Stones on and in the surface layer are generally more than 10 inches across. Some boulders and outcrops of bedrock occur. The subsoil layer is nearly all chert fragments; only a small amount of very cherty silty clay loam is in the crevices.

Fairly large areas of Bodine very cherty silt loam, 1 to 8 percent slopes, and Bodine stony silt loam, 5 to 15 percent slopes, were included in mapping.

Nearly all the acreage of this soil is in woodland or brush. Small areas are in shortleaf pine and hardwoods with patches of native grasses and legumes.

Because this soil is steep, stony, and excessively drained, it is not suitable for cultivated crops. Management that improves soil fertility and structure is needed if this soil is to support trees and range plants. (Capability unit VIIs-1; Steep Chert Savannah range site.)

Bodine stony silt loam, 5 to 15 percent slopes (BoE).—This stony, loamy soil occupies scattered areas on the moderate to steep slopes of the wooded uplands in the central and northern parts of the county. Runoff is medium on the moderate slopes, but it is nearly in the rapid class on the stronger slopes. The high volume of stones and chert on and in the surface layer tends to retard runoff and restrict erosion.

The surface layer is stony or very cherty silt loam about 10 inches thick. Stones on and in the surface layer in most places are more than 10 inches across (fig. 6), and in places bedrock crops out. The subsoil is mainly chert, but there is a small amount of very cherty silty clay loam in the crevices.

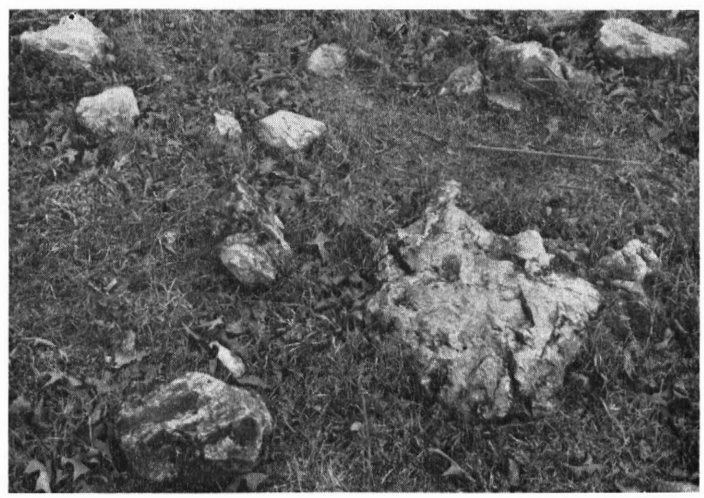

Figure 6.—**Large stones and bedrock are on the surface and throughout the profile of Bodine stony silt loam, 5 to 15 percent slopes.**

Included in mapping are fairly large areas of Bodine very cherty silt loam, 1 to 8 percent slopes, and of Bodine stony silt loam, steep.

Nearly all the acreage of this soil is in cutover woodland and brush, but a small acreage has been cleared and is in strawberries. A few areas are in high-grade hardwoods and shortleaf pine, and a few have patches of native grasses and legumes.

The chief problems on this soil are stoniness and strong slopes. Droughtiness and loss of organic matter are problems if the soil is disturbed. Management that

maintains the organic-matter content, fertility, and structure is needed (*9*). (Capability unit VIs-1; Smooth Chert Savannah range site.)

Bodine very cherty silt loam, 1 to 8 percent slopes (BdD).—This soil, locally called strawberry soil, occurs extensively on gently sloping to strongly sloping wooded uplands in the central and northern parts of the county. Runoff is medium to rapid, depending on the degree of slope and the type of vegetation. Water erosion is restricted by the high volume of chert on the surface and throughout the profile.

The surface layer is very cherty silt loam about 12 inches thick. The volume of chert ranges from 30 to 80 percent. The chert fragments range from ½ inch to 10 inches across but average about 4 inches. Thickness of the subsoil varies, but in most places it is about 12 inches. The volume of chert in the subsoil increases with increasing depth, and the silty clay loam subsoil material occurs only in small amounts in the crevices.

Included with this soil in mapping are fairly large areas of Bodine stony silt loam, 5 to 15 percent slopes, and some small areas of Dickson cherty silt loam, 0 to 3 percent slopes.

Half the acreage of this soil was cleared for strawberries and was later planted to tame pasture or native grasses or allowed to revert to brush. The rest is still in hardwoods and shortleaf pine and scattered areas of native grasses and legumes.

The major problems of this soil are difficulty in tillage caused by the high chert content, droughtiness, and the loss of organic matter in disturbed areas. Management is needed that increases the amount of organic matter and the fertility and improves soil structure (*16*). (Capability unit IVs-1; Smooth Chert Savannah range site.)

Craig Series

The Craig series consists of cherty, strongly acid to medium acid, gently sloping to moderately sloping soils that are on prairies, mainly in the vicinity of Westville.

The surface layer is cherty silt loam that ranges from 6 to 15 inches in thickness. It is grayish brown to dark brown in color and has weak to moderate, granular structure.

The subsoil is cherty silty clay loam that ranges from 9 to 24 inches in thickness. It is reddish brown to red in color and has subangular blocky structure. The texture of the subsoil ranges from very cherty silty clay loam to very cherty silty clay. The parent material is cherty limestone.

Craig soils are somewhat excessively drained. They have medium to rapid internal drainage and moderately rapid permeability.

Craig soils are near the Dickson soils, which have a lighter brown surface layer. Their original vegetation was tall and short prairie grasses.

Craig cherty silt loam, 1 to 5 percent slopes (CrC).—This cherty soil is of minor extent in Adair County. It has gentle to moderate slopes and occurs on the prairie uplands, mostly near Westville. This soil is somewhat excessively drained. Runoff is medium and internal drainage is medium to rapid.

The surface layer is cherty silt loam 6 to 14 inches thick. Because it is cherty, it is hard to work. The subsoil is very cherty heavy silty clay loam 9 to 24 inches thick.

Small areas of Dickson cherty silt loam, 0 to 3 percent slopes, were included in mapping.

Nearly all the acreage is in tame pasture; only a few small areas are in native grasses.

The main problems on this soil are chertiness and droughtiness. Management is needed to conserve moisture by using plant residue as a mulch and to maintain the content of organic matter, the structure, and the fertility. (Capability unit IVe-3; Loamy Prairie range site.)

Dickson Series

In the Dickson series are strongly acid to slightly acid, nearly level to gently sloping soils on wooded or formerly timbered uplands in the central and northern parts of the county.

The surface layer is pale-brown to light brownish-gray silt loam or cherty silt loam about 10 inches thick. It has weak, fine, granular structure and is easy to work when it is not affected by a high content of chert.

The subsoil is about 20 inches thick. It ranges in color from very pale brown to light yellowish brown, brownish yellow, or yellowish brown. Mottling occurs in a few places in the lower part of this layer. The texture ranges from cherty heavy silt loam to cherty silty clay loam. The structure ranges from moderate, medium, granular to subangular blocky. In places a weak to distinct fragipan is present. The depth to chert varies but averages about 34 inches.

Dickson soils are well drained. Permeability is moderate in the upper part of the solum and slow in the lower part.

Dickson soils are near the Bodine soils, which have stronger slopes in most places and are more cherty or stony. They are also near the Lawrence soils, which are on nearly level uplands or in depressions and contain more clay in their subsoil. The original cover of Dickson soils was a forest of hardwoods and pine.

Dickson cherty silt loam, 0 to 3 percent slopes (DkA).—This is a deep, cherty, productive soil that covers large areas of the nearly level or gently sloping uplands in the central and northern parts of the county. Runoff is medium, and erosion is limited by the gentle slopes and by chertiness.

The surface layer is cherty silt loam about 10 inches thick (fig. 7). It contains from 10 to 25 percent chert by volume. The subsoil is cherty heavy silt loam to silty clay loam.

A few small areas of Dickson silt loam, 1 to 3 percent slopes; Bodine very cherty silt loam, 1 to 8 percent slopes; and minor areas of Lawrence silt loam were included in mapping.

The acreage is mostly in orchards, field crops, and cutover woodland and brush, but a few areas still have the original cover of mixed hardwoods, pine, and patches of native grasses and legumes.

The main problem of Dickson cherty silt loam is tillage, which is made difficult in some areas by the high content of chert. Management is needed that conserves moisture by using plant residue as a mulch and that increases the content of organic matter. Fertility should

Figure 7.—**Profile of Dickson cherty silt loam, 0 to 3 percent slopes. About 15 percent of the surface layer consists of chert fragments, which increase in volume and size with increasing depth.**

be maintained for highest production. (Capability unit IIIs–1; Smooth Chert Savannah range site.)

Dickson silt loam, 1 to 3 percent slopes (DcB).—This deep, productive soil covers large areas of the nearly level to gently sloping uplands in the central and northern parts of the county. Runoff is medium, and some small areas are slightly eroded.

The surface layer is silt loam about 10 inches thick. It contains less than 10 percent chert. The subsoil is cherty light silty clay loam or silty clay loam about 24 inches thick. Because the chert content is lower than that in Dickson cherty silt loam, the water-holding capacity of this easily worked soil is greater.

Nearly all the acreage has been cleared and is now in field crops, vegetable crops, orchards, or tame pasture.

Small areas of Dickson cherty silt loam, 0 to 3 percent slopes; Bodine very cherty silt loam, 1 to 8 percent slopes; and minor areas of Lawrence silt loam were included in mapping. The chief hazard of this soil is its susceptibility to water erosion. Management is needed that maintains a thick vegetative cover, fertility, and structure; provides ample crop residue for mulch; and increases the organic-matter content. (Capability unit IIe–2; Smooth Chert Savannah range site.)

Etowah Series

The Etowah series consists of deep, productive, nearly level to strongly sloping soils on terraces along most streams and rivers and in broad valleys throughout the county. These soils developed in alluvium washed mainly from areas of cherty limestone. Reaction ranges from strongly acid to slightly acid.

The friable surface layer is silt loam or gravelly silt loam. It ranges from pale brown to yellowish brown in color and from 8 to 15 inches in thickness. This layer may be almost free of rounded chert pebbles on the surface and in the layer or may contain less than 10 percent of pebbles. In the more gravelly Etowah soils, the volume of gravel ranges from 10 to 30 percent and averages about 15 percent. The volume increases with increasing depth.

The subsoil is heavy silt loam to silty clay loam. It is generally about 16 inches thick, but in some places it may be as much as 45 inches. It is reddish yellow to reddish brown in color and has moderate, medium, granular structure to subangular blocky structure. The volume of gravel in this layer varies widely. In some places the layer is free of gravel, but in other places it contains about 50 percent in the upper part and as much as 80 or 90 percent in the lower part.

The underlying material consists of beds of very gravelly silty clay loam. The percentage of gravel varies widely, but in most places it is between 60 and 80 percent. The thickness of the underlying material ranges from 10 to 40 inches.

The Etowah soils are well drained. They have medium internal drainage and moderate permeability. Their water-holding capacity is generally good, except in places where the volume of gravel is high in all layers.

The Etowah soils are near the Huntington soils, which are on lower bottoms, are subject to occasional floods, and lack a well-developed subsoil. They are also near the Greendale soils, which occur on the higher foot slopes and contain chert fragments that are generally angular and have sharp edges. Chert in the Etowah soils is generally waterworn and rounded.

On slopes of 3 to 8 percent, the Etowah soils are not mapped separately in Adair County but are mapped with Greendale soils in an undifferentiated unit. The Greendale soils are described under the Greendale series, and a profile is described in the section "Formation, Classification, and Morphology of the Soils."

The native vegetation of the Etowah soils consisted of hardwoods and some shortleaf pine. Nearly all the acreage is now in cultivated crops or tame pasture. Under good management, these soils are highly productive. Green beans are grown on much of the area occupied by nearly level and gently sloping Etowah soils. Sprinkler irrigation is sometimes used where these soils are along perennial streams.

Etowah gravelly silt loam, 1 to 3 percent slopes (EoB).—This is a deep, gravelly soil that occurs on terraces along most of the streams and rivers, and in broad valleys throughout the county. The soil is productive if erosion is controlled and fertility is maintained. Runoff is medium, and the soil is only slightly eroded.

The surface layer is gravelly silt loam about 10 inches thick. On the average it contains 15 percent rounded gravel throughout. The subsoil is gravelly heavy silt loam to silty clay loam about 16 inches thick. The volume of gravel in this layer increases with increasing depth.

Nearly all the acreage is in truck crops, vegetable crops, small grain, or tame pasture.

Included in mapping are small areas of Etowah silt loam, 1 to 3 percent slopes; Etowah and Greendale soils, 3

to 8 percent slopes; minor areas of Huntington gravelly loam; and Gravelly alluvial land.

Although it is erosive, this soil is well suited to most crops grown locally and is widely used for green beans. (Capability unit IIe-2; Smooth Chert Savannah range site.)

Etowah silt loam, 0 to 1 percent slopes (EaA).—This deep, naturally productive soil (fig. 8) occurs along most of the streams and rivers, and in broad valleys throughout the county.

Figure 8.—**Profile of Etowah silt loam, 0 to 1 percent slopes, showing friable surface layer and slightly gravelly subsoil. This soil is highly productive if it is managed well.**

The surface layer is friable, easily worked silt loam. It contains less than 10 percent gravel by volume. The subsoil is generally silty clay loam about 16 inches thick. In some places, however, it may be as much as 45 inches thick and may contain little or much gravel throughout.

This is one of the best agricultural soils in the county. Nearly all the acreage is in small grain, truck crops, vegetable crops, orchards, or tame pasture.

Included in mapping are small areas of Etowah silt loam, 1 to 3 percent slopes; Etowah gravelly silt loam, 1 to 3 percent slopes; minor areas of Huntington silt loam; and Huntington gravelly loam.

This soil needs only normally good management for high yields. (Capability unit I-2; Smooth Chert Savannah range site.)

Etowah silt loam, 1 to 3 percent slopes (EaB).—This deep soil closely resembles Etowah silt loam, 0 to 1 percent slopes. It covers fairly large areas in the broad valleys near Stilwell and Westville. Runoff is medium, but the soil is susceptible to erosion.

The surface layer is friable, easily worked silt loam about 10 inches thick. It is less than 10 percent gravel by volume. The subsoil ranges from 16 to 45 inches in thickness. In most places it is silty clay loam. It may contain little or much gravel throughout.

Nearly all the acreage of Etowah silt loam, 1 to 3 percent slopes, is in orchards, small grain, sorghum, or tame pasture.

Included in mapping are small areas of Etowah silt loam, 0 to 1 percent slopes; Etowah gravelly silt loam, 1 to 3 percent slopes; minor areas of Huntington silt loam; and Huntington gravelly loam.

Susceptibility to erosion is the chief hazard on this soil. It is productive and highly responsive to good management. (Capability unit IIe-2; Smooth Chert Savannah range site.)

Etowah and Greendale soils, 3 to 8 percent slopes (EtD).—This mapping unit is extensive. It is an undifferentiated group of soils that consists of about 65 percent Etowah gravelly silt loam and 35 percent Greendale cherty silt loam. In this unit Etowah soils merge with Greendale soils, and separation into two mapping units is not practical. Etowah soils generally are on the lower part of foot slopes, and Greendale soils are generally on the upper part. Etowah soils contain waterworn chert with rounded edges, and Greendale soils contain angular chert with sharp edges. Runoff from these soils is medium but is nearly rapid on the stronger slopes.

Included in mapping are small areas of Etowah gravelly silt loam, 1 to 3 percent slopes; Bodine very cherty silt loam, 1 to 8 percent slopes; Etowah silt loam, 1 to 3 percent slopes; and Huntington gravelly loam.

Nearly all the acreage of this soil is in tame pasture, but green beans are grown near streams where water is available for irrigation.

Water erosion is a chronic problem, especially in areas that are cultivated. Management is needed that prevents erosion and maintains the organic-matter content, fertility, and structure. (Capability unit IVe-2; Smooth Chert Savannah range site.)

Gravelly Alluvial Land (Ga)

This land type consists mostly of gravel and other sediments washed from soils on cherty limestone and from some on sandstone. It is made up of riverbanks, streambanks, channels, gravel bars, and small, frequently flooded low bottoms along all streams and rivers throughout the county. Included in mapping are a few small areas of Huntington gravelly loam and Huntington silt loam.

The natural vegetation of the very gravelly areas con-

sists of willows, water-tolerant hardwoods, brush, and weeds, which are used for browsing.

The small areas of Huntington silt loam and Huntington gravelly loam are not suited to cultivated crops and are generally used for tame pasture. (Capability unit Vw-1; range site not assigned.)

Greendale Series

The Greendale series consists of well-drained, medium acid to very strongly acid soils that developed in creep materials from cherty limestone. These soils occur on moderately sloping to strongly sloping foot slopes and on colluvial and alluvial fans, mostly along streams throughout the county. In Adair County the Greendale soils are mapped only in an undifferentiated group with the Etowah soils.

The surface layer is very pale brown to light brownish gray and is about 10 to 18 inches thick. It has very weak, fine to medium, granular structure. The amount of chert ranges from 10 to 30 percent by volume.

The subsoil is light yellowish-brown to brown silt loam to light silty clay loam. It has weak, granular structure. The chert content ranges from 30 to 50 percent and increases with increasing depth. Thickness ranges from 25 to 50 inches.

The original vegetation was largely hardwoods, but in some small areas it was prairie grasses. Nearly all the acreage has been cleared and now is in cultivated crops or tame pasture.

Water erosion is a problem, especially on the stronger slopes. Crops or pasture produced on these soils require the careful management that prevents erosion, increases the organic-matter content and fertility, and helps maintain soil structure.

Hector Series

Soils of the Hector series are strongly acid to medium acid. They are shallow to very shallow, sandy to stony fine sandly loam soils that occur on gentle to very steep slopes. They are extensive in the southern part of Adair County. Sandstone boulders and ledges crop out commonly in the very shallow soils. In Adair County, Hector soils are not mapped as single soils. They are mapped as Hector-Linker fine sandy loams and as the Hector complex.

The surface layer is grayish-brown to reddish-brown fine sandy loam to stony fine sandy loam. It ranges from 5 to 20 inches in thickness and has a weak, fine to medium, granular structure. In some places a few pebbles or stones are on the surface or in the surface layer. In other places the surface layer contains gravel. Rocks, boulders, and outcrops of sandstone occur.

In many places where the surface layer is about 10 to 12 inches thick, there is a subsurface layer that consists of about 10 inches of reddish-yellow fine sandy loam, sandstone gravel, and partly weathered sandstone underlain by bedrock. The parent material of Hector soils is sandstone and some shale.

The Hector soils tend to be excessively drained. They have medium to rapid internal drainage and moderate to moderately rapid permeability.

The Hector soils are near the Linker soils, which are deeper and have a well-developed subsoil.

The original cover of the Hector soils was a hardwood forest, but nearly all the acreage has been cut over. Most of the acreage of very shallow soils is in woodland and brush. Some of the less shallow soils, however, have been cleared and now are in cultivated crops.

Hector complex (Hc).—The soils of this complex are in the uplands and are generally very steep, but in a few places they are gently sloping. They cover a large area, mainly in the southern part of the county. They formed in material that weathered from sandstone and some shale. About 80 percent of the acreage consists of very shallow, stony soils about 6 inches thick; the rest is intermixed stony and gravelly fine sandy loams about 8 to 12 inches thick. Except in the gently sloping areas, runoff is rapid to very rapid.

The surface layer of most Hector soils is stony fine sandy loam about 6 inches thick. It has many sandstone fragments and boulders, and sandstone ledges are common (fig. 9). This layer is underlain by beds of partly weathered and solid sandstone.

***Figure 9.*—Typical profile of Hector soil in the Hector complex. This complex of soils is extensive in the southern part of Adair County. Bedded sandstone is near the surface of the very shallow Hector soils.**

Included in mapping are small areas of Linker fine sandy loam, 1 to 5 percent slopes; Linker fine sandy loam, 3 to 5 percent slopes, eroded; minor areas of Linker loam, 3 to 5 pecent slopes; and Linker loam, 3 to 5 percent slopes, eroded.

Most of the acreage is in cutover woodland and brush. In some scattered areas among other hardwoods, there are many black walnut trees from which nuts are harvested annually. The soils of this complex are used mainly as woodland range. (Capability unit VIIs-1; Shallow Savannah range site.)

Hector-Linker fine sandy loams, 1 to 5 percent slopes (HIC).—In this complex are sandy and loamy soils of the uplands. They cover a large area mainly in the southern part of the county. The areas of the shallow Hector soils in this complex are so closely intermingled with small areas of the deeper Linker soils that they cannot be shown separately on the soil map. These intermingled soils are mapped together as Hector-Linker fine sandy loams. Some areas of Linker soils, however, are large enough to be mapped separately. These Linker soils are described under the Linker series.

Some sandstone gravel and stones may occur in all soil layers. The surface layer is fine sandy loam mainly about 10 to 12 inches thick but is deeper in occasional pockets.

A subsurface layer occurs in places. It consists of about 10 inches of fine sandy loam, gravel, and rotten sandstone and is underlain by sandstone bedrock.

Hector-Linker fine sandy loams are on gentle to moderate slopes. Runoff is medium to rapid. The soils generally tend to be somewhat excessively drained.

Included in mapping are small areas of Hector complex; Linker fine sandy loam, 3 to 5 percent slopes, eroded; minor areas of Linker loam, 3 to 5 percent slopes; and Linker loam, 3 to 5 percent slopes, eroded.

The original vegetation consisted of hardwoods. About half the acreage was cleared and used for strawberries and green beans. Some areas are now in productive orchards, but the most extensive use is for tame pasture. The uncleared acreage is in cutover woodland and brush. (Capability unit IVe–1; Shallow Savannah range site.)

Huntington Series

The Huntington series consist of deep, brown, strongly acid to slightly acid soils on nearly level first bottoms along most streams throughout the county. These soils are occasionally flooded.

The friable surface layer ranges from brown to grayish brown in color and from 6 to 40 inches in thickness. Its texture varies according to the location in the county but ranges from silt loam to gravelly loam. In most places the surface layer has weak, fine, granular structure. It may be free of gravel or contain as much as 50 percent by volume. Huntington soils, however, lack a well-defined subsoil, because they developed in accumulated stream sediments and are relatively young. In the southern part of the county, small areas of Huntington soils have a sandy loam overwash.

In some places a subsurface layer occurs that is a brown gravelly loam; has porous, massive structure; and is about 15 to 25 inches thick. The volume of gravel varies widely within short distances, but in most places it ranges from 20 to 60 percent.

The underlying material consists of beds of gravel, silt, and sand. The proportion of these materials varies widely, but the volume of gravel in most places is between 60 and 80 percent. The thickness of the underlying material is generally more than 40 inches.

The parent material of Huntington soils consists of stream sediments that washed mainly from soils on cherty limestone but partly from soils on sandstone and shale.

The Huntington soils are naturally well drained. They have moderate to rapid permeability. Their water-holding capacity is good, except in areas where the content of gravel is high.

The Huntington soils are near the Etowah soils, which are on higher bottoms, are seldom flooded, and have a well-defined subsoil. The nearby Gravelly alluvial land contains more gravel throughout and is more frequently flooded than the Huntington soils.

Originally the Huntington soils were covered by a hardwood forest. Nearly all the acreage is now in cultivated crops or tame pasture. Under good management, the soils are highly productive. They are well suited to green beans and other crops grown locally. Sprinkler irrigation is sometimes used on areas along perennial streams.

Huntington gravelly loam (Hu).—This soil occurs in small areas and has slopes of 0 to 1 percent. It is a deep, gravelly, nearly level soil on first bottoms along most of the rivers and smaller streams throughout the county. Runoff is medium, and erosion is slight. The soil is occasionally flooded, especially in the lower areas, during periods of high rainfall.

Thickness of the gravelly loam surface layer varies from place to place, but in most places it is about 9 inches. The amount of gravel ranges from 10 to 50 percent but, on the average, it is between 15 and 20 percent.

A subsurface layer occurs in some places. It is gravelly loam about 15 to 25 inches thick. The amount of gravel in this layer varies widely. In most places it ranges from about 20 to 60 percent. The underlying material may be very gravelly loam or a bed of gravel, silt, and sand.

Included in mapping are small areas of Huntington silt loam; Etowah silt loam, 0 to 1 percent slopes; Etowah gravelly silt loam, 1 to 3 percent slopes; and Gravelly alluvial land.

Most of the acreage is in cultivated crops or tame pasture, but a small acreage is in cutover woodland and brush. (Capability unit IIw–1; range site not assigned.)

Huntington silt loam (Hn).—This is a deep soil that has slopes of 0 to 1 percent. It occurs in small areas on nearly level first bottoms along most rivers and smaller streams. Lower areas are occasionally flooded during periods of unusually high rainfall. Runoff is medium, and erosion is slight.

The silt loam surface layer is underlain in places by a darker subsurface layer. These layers are friable and range from 6 to 40 inches in thickness. They are usually free of gravel (fig. 10) but may contain as much as 10 percent by volume. The underlying material consists of a bed of gravel, silt, and sand.

Included in mapping are small areas of Huntington gravelly loam; Etowah silt loam, 0 to 1 percent slopes; and Etowah gravelly silt loam, 1 to 3 percent slopes.

This is one of the most productive soils in the county. It is well suited to all common field crops. Nearly all the acreage is in cultivated crops or tame pasture. (Capability unit I–1; range site not assigned.)

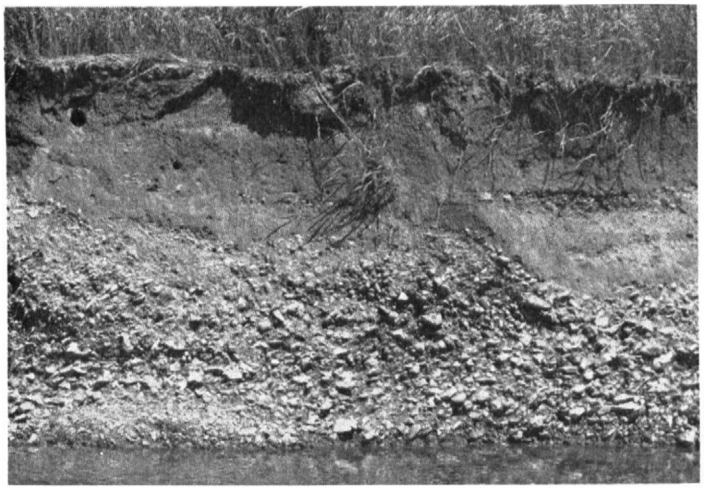

Figure 10.—**Profile of Huntington silt loam. In most places the gravel-free surface layer is underlain by gravel.**

Jay Series

The Jay series consists of deep, strongly acid to medium acid, nearly level to very gently sloping soils of the upland prairies in the vicinity of Stilwell and Westville. Low mounds occur in places.

The silt loam surface and subsurface layers together range from 14 to 30 inches in thickness but in most places are 18 to 26 inches. These layers range from very dark grayish brown to very dark brown in color. The subsurface layer, however, is lighter in most places. Both layers are friable, are easily worked, and have weak, fine, granular structure.

The subsoil ranges from 30 to 50 inches in thickness and averages about 40 inches. It ranges in color from pale brown or brown to light yellowish brown. It is mottled with shades of gray and red. The structure in most places is subangular blocky. The texture ranges from silty clay loam to clay loam. A weak to distinct fragipan is at a depth of 30 to 50 inches. The parent material is loamy alluvium or loess.

The Jay soils are moderately well drained. They have moderate to slow internal drainage and slow permeability.

The Jay soils have less clay in their subsoil than the nearby Taloka and Parsons soils. The native vegetation was grasses. Now almost all the acreage of the Jay soils is in cultivated crops or tame pasture.

Jay silt loam, 0 to 2 percent slopes (JaA).—This soil occurs in small, nearly level to very gently sloping areas. Runoff is medium, and the soil is only slightly eroded.

The silt loam surface and subsurface layers together are about 14 to 30 inches thick. The subsoil is silty clay loam or clay loam and may be from 30 to 50 inches thick.

Included in mapping are minor areas of Taloka silt loam, 0 to 1 percent slopes, and Parsons silt loam, 0 to 1 percent slopes.

This is a productive soil. It is well suited to all field crops commonly grown in the county. Nearly all the acreage is in cultivated crops or tame pasture. Crops respond well to heavy applications of fertilizer. The amount used, however, should be determined by soil tests and field trials.

Management is needed that prevents water erosion and maintains a thick plant cover. Plant residue used as mulch and to increase the content of organic matter improves soil structure. (Capability unit IIe–2; Loamy Prairie range site.)

Lawrence Series

The Lawrence series consists of strongly acid to medium acid soils in small, nearly level areas or slight depressions in the uplands, mainly in the central and northern parts of the county. Water stands in the depressions after heavy rains. Low mounds occur in places.

The silt loam surface layer is pale brown to dark gray. It ranges from 8 to 10 inches in thickness. This layer is friable and has weak, fine, granular structure.

The subsoil ranges from 24 to 40 inches in thickness. It is mottled with very pale brown to light gray. It has moderate, medium, granular to subangular blocky structure. The texture of the subsoil ranges from silty clay loam to silty clay. The content of clay increases with increasing depth. The plastic subsoil is very hard when dry. The parent material is cherty limestone.

Lawrence soils are imperfectly drained. They have slow internal drainage and slow to moderately slow permeability.

The Lawrence soils are not so well drained as the nearby Dickson soils, which have more chert in their surface layer in most places and less clay in their subsoil.

The original vegetation was hardwood forest. About half the acreage is now in tame pasture and the rest is in cutover woodland and brush.

Lawrence silt loam (La).—This deep soil has slopes of 0 to 1 percent and occurs on uplands, mainly in the central and northern parts of the county. It is in small, scattered, nearly level areas or in slight depressions. Low mounds are common. Runoff is slow to medium. The soil is uneroded and is free of chert.

The silt loam surface layer ranges from 8 to 10 inches in thickness. The subsoil ranges from 24 to 40 inches in thickness. It ranges from silty clay loam to silty clay. The content of clay increases with increasing depth.

Included in mapping are small areas of Dickson cherty silt loam, 0 to 3 percent slopes, and of Dickson silt loam, 1 to 3 percent slopes.

About half the acreage is in tame pasture, and the rest is in cutover woodland and brush. (Capability unit IIs–1; range site not assigned.)

Linker Series

The Linker series consists of deep, strongly acid to slightly acid soils of the uplands. Slopes are gentle to moderate. These soils occur mainly in the "Boston Mountains" area in the southern part of Adair County. Fine sandy loam and loam are the dominant soil types.

In most places the surface layer is light brown or pale brown, but it ranges from grayish brown to dark brown. It is loam or fine sandy loam about 6 to 15 inches thick. In places sandy gravel is on the surface and throughout all layers of the fine sandy loam soil type. The Linker soils have a distinct surface and subsurface layer in areas of woodland. These layers have a weak, granular to

weak, fine, granular structure. When the soils are cultivated, however, the upper and lower parts of the surface layers are generally mixed.

The subsoil is about 20 to 26 inches thick. It ranges from yellowish brown to red in color and from sandy clay loam to clay loam in texture. It has weak, medium, granular to subangular blocky structure. The parent material is reddish sandstone with some sandy shale.

Linker soils are naturally well drained. They have medium internal drainage and moderate to moderately rapid permeability.

The Linker soils are near the Hector soils, which are shallower and lack a well-developed subsoil. Also, they do not generally contain sandstone gravel and rock, which are common in the very shallow Hector soil.

The original cover of Linker soils was hardwood forest. Now nearly all the acreage has been cleared, and most of it is in cultivated crops and tame pasture.

Linker fine sandy loam, 1 to 5 percent slopes (LkC).—This deep soil covers fairly wide areas in the southern part of Adair County. Runoff is medium, and in some places the soil is eroded.

The sandy loam surface layer is about 6 to 10 inches thick. The subsoil ranges from 20 to 26 inches in thickness and from sandy clay loam to light clay loam in texture. In a few places sandstone gravel and pebbles occur throughout all layers.

Included in mapping are small areas of Linker fine sandy loam, 3 to 5 percent slopes, eroded; Hector fine sandy loam, 1 to 5 percent slopes; Linker loam, 3 to 5 percent slopes; and Linker loam, 3 to 5 percent slopes, eroded.

Nearly all the acreage of this soil is cleared and is in cultivated crops or tame pasture. High yields of fruit and other crops are obtained under careful management. (Capability unit IIIe–2; Sandy Savannah range site.)

Linker fine sandy loam, 3 to 5 percent slopes, eroded (LkC2).—This soil is in only a few small, scattered areas, mostly in the southern part of the county. Runoff is medium, but water erosion is moderate to severe.

Most of the original 6- to 10-inch surface layer has been lost through water erosion. In some areas material from the subsoil, which was 20 to 26 inches thick, is now part of the plow layer. Some shallow and deep gullies occur from place to place.

Included in mapping are small areas of Linker fine sandy loam, 1 to 5 percent slopes; Linker loam, 3 to 5 percent slopes; and Linker loam, 3 to 5 percent slopes, eroded.

About half the acreage of this soil is in low-producing pasture, and the rest is in cutover woodland and brush. (Capability unit IIIe–4; Sandy Savannah range site.)

Linker loam, 3 to 5 percent slopes (LnC).—This deep soil is mainly in the southern part of the county. It is not so extensive as the Linker fine sandy loam soils. Runoff is medium and erosion is slight.

In most places the loamy surface layer is about 8 to 12 inches thick. The subsoil is medium to light clay loam about 20 to 26 inches thick.

Included in mapping are small areas of Linker loam, 3 to 5 percent slopes, eroded; Linker fine sandy loam, 1 to 5 percent slopes; and Linker fine sandy loam, 3 to 5 percent slopes, eroded.

Nearly all the acreage of this soil is cleared and now is in cultivated crops or tame pasture. High yields of fruit and other crops are obtained under careful management. (Capability unit IIIe–2; Sandy Savannah range site.)

Linker loam, 3 to 5 percent slopes, eroded (LnC2).—This soil is of minor extent. It covers only a few small, scattered areas, mostly in the southern part of the county. Runoff is medium, and water erosion is moderate to severe.

The loamy surface layer is 4 to 6 inches thick. Cultivation has mixed some of the subsoil material with the surface layer. The subsoil is medium to light clay loam about 20 to 26 inches thick. This soil has numerous rills and some shallow and deep gullies.

Included in mapping are small areas of Linker loam, 3 to 5 percent slopes; Linker fine sandy loam, 1 to 5 percent slopes; and Linker fine sandy loam, 3 to 5 percent slopes, eroded.

Most of the acreage of this soil is now in tame pasture, and the rest is in woodland and brush. (Capability unit IIIe–4; Sandy Savannah range site.)

Osage Series

Soils of the Osage series are not extensive in Adair County. They are deep, dark, medium acid to slightly acid soils on nearly level first bottoms along some of the rivers and smaller streams throughout the county. They are occasionally flooded. Low mounds occur in places.

The surface layer is light clay to light clay loam 8 to 15 inches thick. It ranges from dark gray to black in color and has moderate, medium, granular to subangular blocky structure. The subsurface layer is about 8 to 13 inches thick. It is dark gray to very dark gray clay loam distinctly or faintly mottled in places with strong brown. It has moderate, medium, granular to subangular blocky structure. The content of clay in the subsurface layer increases with increasing depth.

Because they developed in clayey sediments washed from soils on limestone and shale and are relatively young, Osage soils lack a well-developed subsoil.

The underlying material ranges from 15 to 30 inches in thickness. It is grayish-brown to dark-gray massive clay with distinct, strong-brown and black mottles. This material may be heavy clay loam in places. The material in all layers is hard when dry and plastic when wet.

Osage soils are poorly drained. They have very slow internal drainage and permeability.

Osage soils are near the Taft soils, which are grayer, have a well-developed subsoil, and are less clayey in all layers.

The original cover of Osage soils consisted of mixed water-tolerant hardwoods. Nearly all the acreage has been cleared. Except for a few small areas that are in cultivated crops or in cutover woodland and brush, these soils are in tame pasture.

Osage clay loam (Oc).—This soil occurs in a few scattered areas on the nearly level first bottoms along the rivers and the smaller streams throughout the county. Slopes range from 0 to 1 percent. Low mounds are common. Runoff is slow, and the soil is subject to occasional flooding.

The surface layer is plastic light clay loam about 8 to 15 inches thick. The subsurface layer is clay loam about

8 to 13 inches thick. The clay content increases with increasing depth. This layer may contain 10 to 15 percent pebbles by volume. The underlying material is about 15 to 30 inches thick. In most places it contains pebbles in varying amounts. Included in mapping are small areas of Taft silt loam.

Nearly all the acreage of this soil is in tame pasture. A few small areas, however, are in cultivated crops or in cutover woodland and brush.

Osage clay loam is poorly drained. In most places it stays wet during winter and early in spring. It is hard and droughty during dry periods. (Capability unit IIIw-2; Heavy Bottomland range site.)

Parsons Series

The Parson series consists of deep, strongly acid to medium acid soils in nearly level areas or in slight depressions on the prairies, mainly near Westville and Stilwell. Low mounds are common.

The surface layer is light brownish-gray to dark grayish-brown silt loam about 8 to 15 inches thick. It has moderate, medium, granular structure.

The subsoil is about 32 inches thick. It ranges from silty clay to clay in texture. This layer contains more clay in depressions than in the nearly level areas. Its color ranges from mottled gray to mottled light yellowish brown. In most places it has weak, medium, blocky structure. The parent material is clayey alluvium underlain by cherty limestone.

The Parsons soils are imperfectly drained. They have very slow internal drainage and permeability.

The Parsons soils have a thinner surface layer and more clay in their subsoil than Jay soils. Also they have a thinner surface layer than the adjacent Taloka soils.

Native prairie grasses formed the original cover, but most of the acreage has been cultivated and now is in tame pasture.

Parsons silt loam, 0 to 1 percent slopes (PaA).—In Adair County this soil is not extensive. It occurs in small, scattered, nearly level areas or in slight depressions on uplands, mainly near Westville and Stilwell. Low mounds are common. Runoff is slow to medium.

The surface layer is acid silt loam about 6 to 10 inches thick. In general, the thickness of the silty clay or clay subsoil ranges from 20 to 32 inches.

Included in mapping are small areas of Jay silt loam, 0 to 2 percent slopes, and Taloka silt loam, 0 to 1 percent slopes.

Most of the acreage of this soil is in tame pasture consisting of cool-season grasses and legumes. The claypan subsoil and imperfect drainage are the chief problems. Water stands on this soil after heavy rains. The soil is very droughty, however, during dry periods. (Capability unit IIs-1; Claypan Prairie range site.)

Sogn Series

The Sogn series consists of dark-colored, gently sloping to strongly sloping, slightly acid to neutral soils of the uplands. The soil occurs in crevices of rocks or as a very shallow layer among outcrops of limestone bedrock, boulders, and flagstones. These outcrops are characteristic of the Sogn soils throughout the county. Runoff is moderate to rapid.

The surface layer is very dark gray to nearly black. It has moderate, medium and fine, granular structure. Its thickness averages about 7 to 8 inches, although deeper pockets may occur at irregular intervals among the rocks. This layer varies in texture. Although in most places it is clay loam, it ranges from silty clay loam to heavy clay loam. Sogn soils lack a developed subsoil layer. They are underlain by dense, bluish-gray limestone. The parent material is limestone.

This soil has slow internal drainage, and its moisture-holding capacity is limited by the small volume of soil material.

Sogn soils are near the Hector soils, which have a lighter colored surface layer that is stony fine sandy loam. Sogn soils resemble the Summit soils in texture and color, but Summit soils are much deeper and have a well-developed subsoil.

Originally, Sogn soils were covered by mixed deciduous trees, brush, and some native grasses.

Sogn soils (So).—These very shallow soils occur throughout the county in scattered areas on gently to strongly sloping uplands. Runoff is medium to rapid, and the moisture-holding capacity is limited by the small volume of soil material.

The surface layer is, on the average, about 7 to 8 inches thick over limestone bedrock. In most places the texture is clay loam, but it ranges from a silty clay loam to heavy clay loam. In the southern part of Adair County, Sogn soils may be covered by an overwash of sandy loam material from nearby Hector soils.

Included in mapping are small areas of Hector complex; Summit silty clay loam, 1 to 3 percent slopes; Summit silty clay loam, 3 to 5 percent slopes; and Summit silty clay loam, 3 to 5 percent slopes, eroded.

Nearly all of the acreage of Sogn soils is in brush, woody shrubs, and poor-quality deciduous trees, but there are small patches of little bluestem and side-oats grama.

Sogn soils are not suitable for cultivation because they are shallow and have many outcrops of limestone. They are used as brushy and wooded range. (Capability unit VIIs-2; Very Shallow range site.)

Summit Series

The Summit series consists of deep, dark-colored, slightly acid to neutral soils on upland prairies. They are nearly level to moderately sloping soils in broad valleys near Stilwell and Westville.

The surface layer is dark grayish-brown to black silty clay loam or clay loam. The thickness of this layer ranges from 6 to 16 inches, but in most places it is about 14 inches. The structure is strong, medium to fine, granular.

The subsoil is mottled light brownish-gray to very dark grayish-brown silty clay loam to silty clay about 34 inches thick. It has strong, medium, granular structure. The parent material consists of weathered limestone and some shale. The depth to the bluish-gray limestone bedrock ranges from 2 to 8 feet. It averages about 50 inches.

Summit soils are moderately well drained. They have medium to slow internal drainage and moderate to

moderately slow permeability. Except in nearly level areas, Summit soils are susceptible to water erosion.

Occurring nearby are small areas of Sogn soils, which resemble Summit soils in color and texture but are very shallow and have numerous flagstones and rock outcrops. Summit soils, in contrast, are 2 to 8 feet deep to bedrock.

Originally, the Summit soils were in native prairie grasses.

Summit silty clay loam, 0 to 1 percent slopes (SuA).—This nearly level soil occurs in small areas with other Summit soils, mainly in the vicinity of Stilwell and of Westville. Runoff is medium. The soil is moderately well drained.

The surface layer is dark-colored silty clay loam about 14 inches thick. In some small areas this layer contains more clay than normal. In these areas the soil hardens and cracks during dry periods. The subsoil is light silty clay loam about 34 inches thick. This layer becomes more clayey and more olive colored with depth.

Included in mapping are small areas of Summit silty clay loam, 1 to 3 percent slopes, and Parsons silt loam, 0 to 1 percent slopes.

All of this soil is in cultivated crops or tame pasture. It is productive and responds to management that maintains fertility and a high content of organic matter. In some places drainage is a minor problem. (Capability unit I–3; Loamy Prairie range site.)

Summit silty clay loam, 1 to 3 percent slopes (SuB).—This gently sloping soil occurs on prairie uplands in small areas in the central and northern parts of the county. Although it closely resembles Summit silty clay loam, 0 to 1 percent slopes, with which it generally occurs, this soil has steeper slopes. Also, it has a greater amount of runoff, and water erosion is a greater hazard.

The surface layer is dark-colored silty clay loam about 14 inches thick. The subsoil is light silty clay loam about 34 inches thick. With increasing depth, the soil is more clayey and more nearly olive colored.

Included in mapping are small areas of Summit silty clay loam, 0 to 1 percent slopes; Summit silty clay loam, 3 to 5 percent slopes; and Summit silty clay loam, 3 to 5 percent slopes, eroded.

All the acreage of this potentially productive soil is in cultivated crops or tame pasture.

To protect this important agricultural soil, management is needed that prevents water erosion and maintains a high organic-matter content, good tilth, and soil fertility. (Capability unit IIe–1; Loamy Prairie range site.)

Summit silty clay loam, 3 to 5 percent slopes (SuC).—This soil occurs in small areas with other Summit soils in the central and northern parts of the county. Runoff, although greater than on the less sloping soil, is medium, and the soil is only slightly eroded.

The surface layer is dark-colored silty clay loam. It is normally 14 inches thick, but in a few places it has lost some soil through erosion. The subsoil is light silty clay loam about 34 inches thick.

Included in mapping are small areas of Summit silty clay loam, 3 to 5 percent slopes, eroded; Summit silty clay loam, 1 to 3 percent slopes; and Sogn soils.

Nearly all the acreage of this soil is in tame pasture or in cultivated crops.

Because this soil is moderately sloping, its chief hazard is water erosion. It requires management that maintains organic matter, fertility, and structure. (Capability IIIe–1; Loamy Prairie range site.)

Summit silty clay loam, 3 to 5 percent slopes, eroded (SuC2).—This eroded, formerly productive soil occurs in small areas on the moderately sloping prairies in the vicinity of Stilwell and Westville. Runoff is medium.

Before erosion, the surface soil was normally 10 to 14 inches thick, but erosion has removed much of this layer. The subsoil is light silty clay loam and was originally about 34 inches thick. Now part of it is mixed into the plow layer.

Included in mapping are small areas of Summit silty clay loam, 1 to 3 percent slopes, and of Sogn soils.

All the acreage of this soil is in tame pasture. The erosion hazard is the major problem. Occasional deep gullies occur in places. Practices that prevent gullying and the further loss of soil are needed. These practices, however, can be determined for each particular field only by a study at the site. (Capability unit IIIe–3; Loamy Prairie range site.)

Taft Series

The Taft series consists of nearly level, strongly acid to slightly acid soils. They are relatively inextensive in Adair County, and they occur mainly on second bottoms along Barren Fork and the Illinois River. Low mounds are common. These soils were formed in sediments that washed from areas of cherty limestone and from minor areas of limestone and shale.

The surface and subsurface layers together are about 22 inches thick. The surface layer is dark grayish-brown to gray silt loam about 10 inches thick. It has weak, fine, granular structure. The subsurface layer is light-gray silt loam with faint yellow mottles. It is about 12 inches thick and has weak, fine, granular structure.

The subsoil is light clay loam to light clay about 17 to 20 inches thick. It is pale brown to light gray and is distinctly mottled with yellowish brown. It is firm when moist and very hard when dry and has moderate, medium, blocky structure. Depth to very gravelly chert ranges from 3 to 6 feet.

Taft soils are imperfectly drained. They have very slow internal drainage and slow permeability.

These soils are near the Osage soils, which are darker and have more clay in all layers. Originally, the Taft soils were covered by hardwood forests and savannahs.

Taft silt loam (Ta).—This nearly level soil is on slopes of 0 to 1 percent and occurs in small areas on second bottoms, mainly along the Illinois River and Barren Fork (fig. 11). Low mounds are common. Runoff is very slow.

The surface layer is silt loam about 10 inches thick. The subsurface layer also is silt loam, but it is lighter colored than the surface layer and is faintly mottled. It is about 12 inches thick.

The subsoil ranges from light clay loam to light clay. In most places it is about 17 to 20 inches thick. Included in mapping are small areas of Osage clay loam.

Nearly all the acreage of this soil is in tame pasture, but a few small fields are in crops. The main problems are imperfect drainage and occasional ponding after heavy rains. Management is needed that improves drainage and maintains fertility, structure, and the content of

organic matter. (Capability unit IIIw-1; range site not assigned.)

Figure 11.—Profile of Taft silt loam.

Taloka Series

The Taloka series consists of nearly level, strongly acid to medium acid, light-colored soils on upland prairies. They occur only in small areas near Stilwell and Westville. Low mounds are common.

The surface layer has an average thickness of about 20 inches. It is silt loam and is slightly mottled with very pale brown to light gray. It has weak, medium, granular structure. Many roots are in the surface and subsurface layers.

The subsoil is light silty clay mottled with light gray to grayish brown. It ranges from 40 to 50 inches in thickness and has moderate, medium, subangular blocky structure. Few roots occur in the subsoil. This layer is plastic when wet and hard when dry. The parent material is clayey and silty alluvium.

Taloka soils are imperfectly drained. They have very slow internal drainage and permeability.

These soils have less clay in their subsoil and a thicker surface layer than the nearby Parsons soils. They have more clay in their subsoil than the Jay soils. The native vegetation of Taloka soils was tall prairie grasses.

Taloka silt loam, 0 to 1 percent slopes (TkA).—This is a productive, nearly level, imperfectly drained soil on prairie uplands. It occurs in small areas in the vicinity of Stilwell and Westville. Low mounds are common. Runoff is slow.

The surface layer is silt loam 8 to 10 inches thick. The subsurface layer is lighter colored and slightly mottled silt loam about 13 to 15 inches thick.

The subsoil ranges from 40 to 50 inches in thickness. It is light silty clay. The content of clay, however, increases with increasing depth.

Included in mapping are small areas of Parsons silt loam, 0 to 1 percent slopes, and Jay silt loam, 0 to 2 percent slopes.

Nearly all the acreage of Taloka silt loam, 0 to 1 percent slopes, is in tame pasture, but a small acreage is in cultivated crops.

The main problems of this deep, productive soil are imperfect drainage and low fertility. Although it is wet during winter and early in spring, this soil is droughty in summer. A particular field may show a need for some kind of artificial drainage. Management is required that maintains a thick stand of cool-season grasses and legumes. This kind of plant cover adds organic matter to the soil, improves structure, and helps to offset droughtiness. (Capability unit IIs-1; Loamy Prairie range site.)

Use and Management of Soils

In this section, the general practices of soil management in Adair County are first discussed. The capability classification used by the Soil Conservation Service is briefly explained. The soils are placed in capability groups, and the use and management of each group is discussed. Yield predictions are given for the soils that are suitable for cultivation. The use and management of the soils for woodland, wildlife, and range and the use of soils for engineering are also discussed.

General Management Practices [5]

The chief problems of management for tilled crops in Adair County are discussed in this subsection, together with practices that protect the soil and help to produce good yields for a long period. Because it has favorable climate and soil, Adair County is one of the most important strawberry-producing counties in the United States. Apples, peaches, beans, and okra are also grown for sale and are processed by local plants. Because of their high value, these crops require a high level of management.

Other crops grown are small grain, sorghum, and corn. Alfalfa is suited to the well-drained soils on bottom lands and to the permeable soils on uplands if the right amount of lime is applied. Grasses are dependable in cool or warm seasons. They are excellent soil conditioners when used in a long cropping system.

The main problems of management are (1) protecting cropland from erosion, (2) maintaining tilth, and (3) supplying adequate plant nutrients. The most important practices to use in solving these problems are minimum tillage, rotating soil-depleting crops with soil-improving crops, planting cover crops, managing crop residue, applying fertilizer and lime, and growing tame pasture crops.

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[5] E. O. Hill, conservation agronomist, Soil Conservation Service, assisted in writing this subsection.

The main objectives of a cropping system are the maintenance of good tilth, the protection of the soil from erosion, and control of weeds, insects, and disease. A good cropping system includes grasses and legumes (fig. 12) or a high residue producing crop, which may be either a legume or a nonlegume. If a nonlegume crop is used, a total of 35 to 40 pounds of nitrogen fertilizer per acre is needed to aid the decomposition of plants and to prevent nitrogen deficiency.

***Figure 12.*—A highly productive tame pasture consisiting of ladino clover and fescue near Westville. Soil is Etowah silt loam, 1 to 3 percent slopes.**

When planning the use and management of soils for cultivated crops, the crops grown locally are classified according to their effect on the soils. They are classified as high residue producing, or soil-improving crops, if their residue is returned to the soil and is 3,500 pounds, or more, per acre. Examples of high residue producing crops (if the residue is retained and amounts to 3,500 pounds, or more) are (1) small grain, (2) corn or other row crops if enough residue is returned, (3) adapted and well-managed legumes, (4) alfalfa if 12 inches of top growth is returned to the soil during the life of the stand, and (5) grasses that leave at least 6 inches of stubble. Other soil-improving crops are grasses grown 1 year or more, well-fertilized nonlegumes that produce much residue, and properly managed legumes that have their residue returned to the soil.

The crops grown locally are classified as low residue producing, or soil-depleting, crops if the residue returned to the soil is less than 3,500 pounds per acre. Examples of low residue producing, or soil-depleting, crops are (1) soybeans or mungbeans, (2) crops used for silage or soiling, (3) truck crops or vegetables, and (4) other crops producing less than 3,500 pounds of residue.

This subsection and the subsection "Management by Capability Units" are designed to help farmers and landowners select suitable management practices for soils on their farms. The yields expected under customary management and under improved management are given in table 6. These estimates are additional guides in selecting a conservation program for an individual farm.

Generally, a combination of management practices is the most effective. But whatever combination of practices is selected, the production and management of crop residues are essential in controlling erosion and maintaining soil tilth. The more important general management practices are discussed in the following pages.

Minimum tillage.—Use of minimum tillage is necessary on all soils in the county. Soils that are cropped must be worked to prepare a seedbed, to control weeds, and to provide a favorable place for plants to grow. Excessive tillage, however, breaks down soil structure. If it is cultivated when too wet, the soil tends to puddle and crust. As a result, it takes in less water and air and stores less moisture.

Compaction from excessive and untimely tillage is a problem on the medium- and fine-textured soils. When farm implements are used too often to the same depth, a plowpan develops just below plow depth. It reduces aeration and moisture penetration and restricts normal root growth.

Cover crops.—These crops are grown extensively in orchards and after vegetable crops to protect the soils from erosion during winter and early in spring. The experience of farmers in the county proves that the benefits from cover crops more than offset their cost. The use of small grain and vetch as a cover crop increases the yield of other crops that follow in the cropping sequence.

Crop residue management.—It is necessary to leave crop residue on the surface during winter and early in spring or to work it partly into the surface layer. Organic matter, or humus, supplied by plant remains improves the tilth of the surface soil. It also increases infiltration and storage of water and reduces crusting and soil erosion.

Fertilizer.—Fertilizer is needed on all cultivated soils in the county. The kind and amount of fertilizer used, however, should be based on soil tests and on current information from the Oklahoma Agricultural Experiment Station. Most soils in this county also need lime.

Grassed waterways.—These waterways are often needed to provide safe disposal of excess water (fig. 13). They are used as outlets for terraces, in natural drains, and in other farming operations. Bermudagrass is one of several good grasses used in Adair County in waterways. Each waterway must be individually designed to the correct width and depth to slow the flow of water and control erosion. Also, perennial plants are needed to provide permanent cover and protection.

Tame pasture.—Tame pasture can be used profitably by livestock farmers and ranchers of Adair County. Grass is an economical feed for livestock, and, if managed well, is a good soil-improving crop.

A basic grass is the foundation for all permanent tame pasture. When planning to establish a tame pasture, it is necessary to consider (1) the needs of the soil, (2) the needs of the farmer, (3) the season when additional forage is needed, (4) the grass best suited to the soil, and (5) the most suitable legume to grow with the selected basic grass.

Figure 13.—A typical grassed waterway under a dense cover of bermudagrass. This waterway safely carries away excess water and provides additional grazing.

If brush and weeds are controlled, the pasture will produce more forage and its use will be prolonged. A mixture of legumes and grasses is preferred for permanent pasture. Korean lespedeza and other legumes are high in protein, calcium, and phosphorus, and grasses are high in carbohydrates. A well-balanced pasture consists of a mixture of about 60 to 80 percent grass and 20 to 40 percent legumes.

Regular applications of fertilizer are needed to keep pasture in high production. In Adair County, the amount of nitrogen and phosphate needed is usually high, but the amounts of potash and lime needed depend on the kind of soil. Although the yield and the appearance and vigor of plants are an indication of fertility needs, a reliable soil test should be used. Each pasture must have adequate watering facilities.

Grazing management directly affects the amount of forage produced. If pasture is grazed at a rate that maintains a good stand of grasses and legumes for a long period, it will have a good ground cover for protection against erosion (fig. 14).

Figure 14.—A good stand of bermudagrass in a field that formerly was in strawberries. Soil is Bodine very cherty silt loam, 1 to 8 percent slopes.

Capability Grouping of Soils

The capability classification is a grouping that shows, in a general way, how suitable soils are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. Eight capability classes are in the broadest grouping and are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products. Adair County has no class VIII soils.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be as many as four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony, and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it are subject to little or no erosion but have other limitations that confine their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIe-2.

Soils are classified in capability classes, subclasses, and units according to the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The capability classes, subclasses, and units in this county are described in the list that follows.

Class I. Soils that have few limitations that restrict their use.

Capability unit I-1.—Deep, nearly level, loamy soils of bottom lands, easy to work and subject to occasional flooding.

Capability unit I-2.—Deep, friable, loamy soils on high bottoms and upland valleys.

Capability unit I-3.—Deep, nearly level, friable silty clay loams that are on prairies and have a moderately heavy subsoil.

Class II. Soils that have some limitations that reduce the choice of plants or require moderate conservation practices.
- Subclass IIe. Soils subject to moderate erosion if they are not protected.
  - Capability unit IIe-1.—Deep, gently sloping, friable silty clay loams that are on prairies and have a moderately heavy subsoil.
  - Capability unit IIe-2.—Deep, gently sloping, loamy or gravelly soils on high bottoms or upland valleys.
- Subclass IIs. Soils that have moderate limitations of moisture capacity or tilth.
  - Capability unit IIs-1.—Deep, nearly level soils on uplands or in slight depressions that have a loamy surface layer and a clayey subsoil.
- Subclass IIw. Soils that have moderate limitations because of excess water.
  - Capability unit IIw-1.—Deep, nearly level, well-drained, gravelly soils on bottom lands that are subject to occasional flooding.

Class III. Soils that have severe limitations that reduce the choice of plants, or require special conservation practices, or both.
- Subclass IIIe. Soils subject to severe erosion if they are cultivated and not protected.
  - Capability unit IIIe-1.—Deep, moderately sloping, friable silty clay loams that are on prairies and have a moderately heavy subsoil.
  - Capability unit IIIe-2.—Deep, gently to moderately sloping, well-drained, loamy or sandy soils on uplands.
  - Capability unit IIIe-3.—Deep, moderately sloping, eroded silty clay loams that are on prairies and have a clayey subsoil.
  - Capability unit IIIe-4.—Deep, moderately sloping, eroded, loamy soils on uplands.
- Subclass IIIs. Soils that have severe limitations of moisture capacity or tilth.
  - Capability unit IIIs-1.—Deep, nearly level to gently sloping, forested soils that contain chert throughout.
- Subclass IIIw. Soils that have severe limitations because of excess water.
  - Capability unit IIIw-1.—Deep, nearly level, moderately wet soils on bottom lands or in slight depressions that have a loamy surface layer and a clayey subsoil.
  - Capability unit IIIw-2.—Deep, nearly level, clayey soils of bottom lands that are subject to occasional flooding.

Class IV. Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.
- Subclass IVe. Soils subject to very severe erosion if they are cultivated and not protected.
  - Capability unit IVe-1.—Shallow, moderately sloping to gently sloping, sandy, forested soils that may be stony.
  - Capability unit IVe-2.—Deep, gravelly, strongly to moderately sloping, well-drained soils on high bottoms and foot slopes.
  - Capability unit IVe-3.—Deep, gently sloping to moderately sloping, droughty soils on prairies; contain chert throughout.
- Subclass IVs. Soils that have very severe limitations of stoniness, low moisture capacity, or other soil features.
  - Capability unit IVs-1.—Deep, gently sloping to strongly sloping, droughty, forested soils that contain much chert throughout.

Class V. Soils not likely to erode that have other limitations, impractical to remove without major reclamation, that limit their use largely to pasture or range, woodland, or wildlife food and cover.
- Subclass Vw. Soils too wet for cultivation; drainage or protection not feasible.
  - Capability unit Vw-1.—Gravelly alluvial land that is frequently flooded.

Class VI. Soils that have severe limitations that make them generally unsuitable for cultivation and that limit their use largely to pasture or range, woodland, or wildlife food and cover.
- Subclass VIs. Soils generally unsuitable for cultivation and limited for other uses by their moisture capacity, stones, or other features.
  - Capability unit VIs-1.—Very cherty or stony, moderately sloping to steep, droughty, forested soils.

Class VII. Soils that have very severe limitations that make them unsuitable for cultivation without major reclamation and that restrict their use largely to grazing, woodland, or wildlife.
- Subclass VIIs. Soils very severely limited by moisture capacity, stones, or other soil features.
  - Capability unit VIIs-1.—Very steep to undulating soils that may contain chert or sandstone fragments, or boulders and rock ledges.
  - Capability unit VIIs-2.—Very shallow, gently sloping to strongly sloping soils that have many outcrops of limestone aand contain rocks and boulders.

Management by capability units

In the following pages, the soils in each capability unit are listed, and some suggestions for their management are made. The management suggested for each capability unit is to be considered in relation to the basic practices of management described in the subsection "General Management Practices."

CAPABILITY UNIT I-1

The only soil in capability unit I-1 is Huntington silt loam. It is a deep, brown, loamy soil that is on the nearly level first bottoms of most streams and rivers throughout the county. It is well drained and highly productive.

Crops well suited to this soil are small grain, corn, alfalfa, tame pasture, and truck crops. The maintenance of good tilth and fertility are the principal problems, but occasional flooding is a problem during periods of heavy rainfall.

Practices that maintain fertility and soil structure include the use of crop residue, a conservation cropping system, fertilizer, and minimum tillage. A conservation cropping system is a sequence of crops grown in combination with needed cultural and management practices. In

a conservation cropping system on this soil, vetch or other soil-improving crops are needed at least 1 year in 4, or a soil-depleting crop may be grown for 3 consecutive years following alfalfa.

CAPABILITY UNIT I-2

The only soil in this capability unit is Etowah silt loam, 0 to 1 percent slopes. It is a deep, pale-brown to yellowish-brown, loamy soil that occurs on second bottoms or in broad valleys throughout the county. It is nearly level, well drained, and highly productive under good management.

Crops well suited to this soil are corn (fig. 15), green beans, alfalfa, small grain, and other crops grown locally. The maintenance of good tilth is the principal problem of management.

Figure. 15.—**Excellent stand of corn on Etowah silt loam, 0 to 1 percent slopes. In the foreground is residue from small grain.**

Practices that maintain fertility and soil structure are the use of crop residue, a conservation cropping system, fertilizer, and minimum tillage. A conservation cropping system that conserves water and maintains fertility consists of a soil-improving crop for at least 2 years in 6, and a soil-depleting crop not more than 4 years in 6.

CAPABILITY UNIT I-3

The only soil in this capability unit is Summit silty clay loam, 0 to 1 percent slopes. It is a deep, dark, nearly level soil that occurs on prairies. It is moderately well drained, has a loamy surface layer and a clayey subsoil, and is productive under good management.

Crops that grow well on this soil are small grain, corn, and tame pasture. Surface crusting and the maintenance of good tilth are the main problems.

The use of minimum tillage, crop residue, a conservation cropping system, and fertilizer are practices needed to improve and maintain good tilth and fertility. A good cropping system consists of small grain followed by annual lespedeza. If corn or some other soil-depleting crop is grown, a suitable cropping system is 3 years of a row crop followed by 1 year of vetch with small grain.

CAPABILITY UNIT IIe-1

The only soil in this capability unit is Summit silty clay loam, 1 to 3 percent slopes. It is a deep, dark, moderately well drained, gently sloping soil on prairies. In most places it has a loamy surface layer and a clayey subsoil, but some small areas with a clayey surface layer were included in mapping. This soil is potentially productive.

Crops well suited to this soil are small grain, tame pasture, and corn. Erosion and loss of moisture through runoff are the main problems.

Practices needed to control erosion and runoff are terracing, contour farming and using crop residue, a conservation cropping system, minimum tillage, and fertilizer. A good cropping system on terraced and contoured fields consists of a row crop for 3 years followed by vetch or another legume for 1 year. On fields not terraced, close-growing crops should be grown continuously. Fescue or some other soil-improving crop should be grown for at least 2 years in 4, and small grain or some other close-growing crop should be grown in the other 2 years. All crop residue should be returned to the soil every year.

CAPABILITY UNIT IIe-2

In this capability unit are deep, productive, pale-brown to grayish-brown soils that are loamy or gravelly. These soils have gentle slopes and occur on second bottoms, on prairies, or in formerly timbered areas. They are well drained to moderately well drained. The soils are—

Dickson silt loam, 1 to 3 percent slopes.
Etowah gravelly silt loam, 1 to 3 percent slopes.
Etowah silt loam, 1 to 3 percent slopes.
Jay silt loam, 0 to 2 percent slopes.

Most crops grown locally are suited to these soils (fig. 16), although strawberries generally are not grown on the Jay soils. The main problems are erosion and loss of moisture through runoff.

Practices required to control erosion are managing crop residue, terracing, contour farming, fertilizing, and using cover crops and minimum tillage. A suitable cropping system for fields that are terraced and contour farmed is row crops for 2 years, followed by a winter small grain for 1 year and then by small grain and a winter legume for 1 year. A cover crop is needed between low residue producing row crops.

Soil-improving and high residue producing crops are needed at least half of the time. Soil-depleting crops should not be grown more than 2 consecutive years. A large amount of crop residue is required annually to maintain productivity and good tilth. A desirable cropping system for fields not terraced is small grain and lespedeza grown continuously. Much crop residue should be returned annually.

CAPABILITY UNIT IIs-1

This capability unit consists of deep, moderately productive, imperfectly drained, brownish-gray soils. These soils have a loamy surface layer and a clayey subsoil.

Figure 16.—**Irrigating green beans on second bottom along Peavine Creek. The soil is Etowah gravelly silt loam, 1 to 3 percent slopes.**

They occur in nearly level areas or in slight depressions on the prairies or on formerly timbered uplands. The soils are—

Lawrence silt loam.
Parsons silt loam, 0 to 1 percent slopes.
Taloka silt loam, 0 to 1 percent slopes.

Small grain, grain and forage sorghum, and tame pasture are the crops best suited to these soils. The main problems are slow intake of water, droughtiness, and poor tilth. The soils are acid and low in natural fertility.

A good cropping system is small grain and annual lespedeza grown continuously, or 3 years of grain sorghum followed by 2 years of a small grain and vetch mixture. Other practices needed are managing crop residue, fertilizing, and minimum tillage.

CAPABILITY UNIT IIw-1

The only soil in this capability unit is Huntington gravelly loam. It is a brown, loamy, well-drained soil on nearly level first bottoms. In most places it has 15 to 20 percent gravel in the surface layer. The amount of gravel increases with increasing depth. Truck crops, small grain, corn, and tame pasture are grown on this soil in most places. The main problems are occasional damaging floods and in some places gravel in the surface layer, which makes tillage difficult.

To maintain a high level of production and to improve tilth, management of crop residue, minimum tillage, and fertilization are needed. A cropping system should have not more than 3 years of soil-depleting crops, and not less than 1 year of a soil-improving crop.

CAPABILITY UNIT IIIe-1

The only soil in this capability unit is Summit silty clay loam, 3 to 5 percent slopes. It is a deep, dark, moderately well drained soil that occurs on moderately sloping prairies. The surface layer is loamy, and the subsoil is light silty clay loam. The content of clay increases with increasing depth.

The loss of soil and water makes this soil unsuitable for row crops, unless the fields are terraced and contour farmed.

Crops generally grown on this soil are small grain and tame pasture. Erosion and loss of moisture through runoff are the main problems.

Needed practices that control erosion and runoff are terracing, contour farming, returning crop residue to the soil, and using a conservation cropping system and fertilizer. A suitable cropping system on fields not terraced is continuous small grain overseeded with annual lespedeza. On terraced fields, soil-improving crops are needed at least 1 year in 3, or a soil-depleting crop can be grown 2 years in 3. Production can be maintained if all crop residue is returned to the soil yearly and if adequate amounts of fertilizer are added.

CAPABILITY UNIT IIIe-2

This capability unit consists of deep, brownish, friable, well-drained soils that are loamy or sandy. These soils have gentle to moderate slopes and occur on uplands. The soils are—

Linker fine sandy loam, 1 to 5 percent slopes.
Linker loam, 3 to 5 percent slopes.

Under careful management, these soils produce good yields of fruit, truck crops, small grain, corn, sorghum, and tame pasture. Some of the best orchards in the county are on these soils. Erosion and loss of moisture through runoff are the main problems.

Intensive erosion control practices are needed. These practices include terracing, contour farming, managing crop residue, and using a conservation cropping system and fertilizer. On terraced fields, vetch or some other soil-improving crop is needed at least 1 year in 3. On fields not terraced, not more than 2 years of close-growing crops, followed by 2 years of soil-improving crops, is a satisfactory cropping sequence. Use of cover crops and the return of all crop residue to the soil are essential in maintaining yields.

CAPABILITY UNIT IIIe-3

The only soil in this capability unit is Summit silty clay loam, 3 to 5 percent slopes, eroded. It is a deep, dark, moderately well drained, moderately sloping soil on upland prairies. The surface layer is loamy, and the subsoil is light silty clay loam. The content of clay increases with increasing depth. Because the soil is eroded, some subsoil material has been mixed with the surface layer in places. Numerous rills and some shallow and deep gullies occur.

Tame pasture is best suited to this eroded soil. Erosion and runoff are the principal problems.

Practices needed to control erosion in cropped areas are terracing, contour farming, fertilizing, and returning crop residue to the soil. A suitable cropping system consists of continuous small grain overseeded with annual lespedeza. Soil-improving crops are needed at least every other year. Production can be maintained if all crop residue is returned to the soil and an adequate amount of fertilizer is applied.

CAPABILITY UNIT IIIe-4

This capability unit consists of deep, brownish, friable soils that are sandy or loamy. These soils are well drained, have moderate slopes, and occur on uplands. Because these soils are eroded, plowing has mixed part of the subsoil with the plow layer in places. Numerous rills and some shallow and deep gullies occur. The soils are—

Linker fine sandy loam, 3 to 5 percent slopes, eroded.
Linker loam, 3 to 5 percent slopes, eroded.

The best use of these soils is for tame pasture, but they can be used for orchards, small grain, or sorghum. Erosion and runoff are the principal problems.

If these soils are cropped, they need intensive practices that control erosion. These practices include terracing, contour farming, fertilizing, and managing crop residue. Soil-improving crops are needed every other year. A good cropping system consists of small grain and vetch grown continuously. Use of cover crops and crop residue is essential in orchards grown on these soils.

CAPABILITY UNIT IIIs-1

The only soil in this capability unit is Dickson cherty silt loam, 0 to 3 percent slopes. It is a light-colored, cherty, nearly level or gently sloping soil on forested uplands. It is extensive in the northern half of the county. The soil is well drained, loamy, and friable. It has from 10 to 25 percent chert fragments in the surface layer. The volume of chert increases with increasing depth. Permeability is moderate in the upper part of this soil and slow in the lower part.

This soil is best suited to orchards, strawberries, and tame pasture plants, including bermudagrass and clover. It is moderately well suited to small grain, corn, and vegetables. The large content of chert, however, makes cultivation difficult in some places.

Unless a good tame pasture is established following strawberries, brush and weeds grow up rapidly on this soil. Bermudagrass is more productive if one or more legumes, such as yellow hop clover or Korean lespedeza, are seeded with it, and adequate fertilizer is applied. A suitable cropping system is 2 years of small grain followed by not less than 1 year of a soil-improving crop. Row crops should not be grown more than 2 consecutive years and should be followed by not less than 2 years of a soil-improving crop.

CAPABILITY UNIT IIIw-1

The only soil in this capability unit is Taft silt loam. It is a deep, light-gray or brownish-gray soil in nearly level areas on second bottoms. Low mounds are common. The loamy surface layer is underlain by a clayey subsoil.

This soil is best suited to a fescue-legume mixture for tame pasture. Wheat, oats, and other small grain may be grown. The main problems are imperfect drainage and occasional ponding after heavy rains. Minor problems are the maintenance of fertility and structure.

Surface drainage, management of crop residue, and the use of fertilizer are needed if this soil is cropped. A suitable cropping system is small grain for 2 years, followed by small grain and a winter legume for 1 year. A crop that produces a high residue is needed at least 1 year in 3.

CAPABILITY UNIT IIIw-2

The only soil is this capability unit is Osage clay loam. It is a dark-gray to black, deep, nearly level soil on first bottoms. Low mounds occur in places. The light clay loam surface layer is underlain by a more clayey subsoil.

Small grain, fescue, bermudagrass, and ladino clover are crops best suited to this soil. The main problems are poor drainage, poor aeration, occasional flooding, and difficult tillage.

The practices needed to keep this soil in the best workable condition and to maintain fertility include managing crop residue, minimum tillage, and fertilizing. A suitable cropping system is at least 2 years of soil-improving crops and not more than 2 years of soil-depleting crops. This soil is best used for continuous tame pasture consisting of a mixture of fescue and clover.

CAPABILITY UNIT IVe-1

A complex of Hector-Linker fine sandy loams, 1 to 5 percent slopes, makes up this capability unit. These soils are brownish, sandy, and well drained to excessively drained. They have moderate to gentle slopes and occur in forested uplands. They are generally shallow and may have sandstone fragments or stones in the surface layer or in lower layers.

Because they are shallow and likely to erode if cultivated, the soils in this capability unit are best suited to tame pasture, such as sericea lespedeza or a mixture of bermudagrass and a legume. After the soils are cleared, strawberries and beans are grown, but the loss of soil is high during this period. Orchards may be productive, but cover crops are needed continuously to prevent excessive erosion. An adequate amount of fertilizer is needed for high yields.

CAPABILITY UNIT IVe-2

In this capability unit are Etowah and Greendale soils, 3 to 8 percent slopes, which are mapped as an undifferentiated group. These soils are extensive. They are deep, brownish, well-drained, gravelly or cherty soils with moderate to strong slopes. They occur on second bottoms along most of the streams and rivers throughout the county. Runoff is medium on gentle slopes, but it is more rapid on the stronger slopes.

Truck crops, strawberries, and tame pasture grow well on these soils, but small grain and other crops can be grown. Erosion and the maintenance of productivity are the main problems.

Practices required to control erosion and maintain fertility include the use of high residue producing cover crops, fertilizer, and minimum tillage. If row crops are grown, diversion terraces and contour farming are needed. A suitable cropping system consists of a soil-improving crop 3 years in 4 and a soil-depleting crop not more than 1 year in 4. Row crops should be followed by a fall-sown cover crop. A truck crop can be grown every year if it is followed by a fall-sown cover crop that produces much residue.

CAPABILITY UNIT IVe-3

The only soil in this capability unit is Craig cherty silt loam, 1 to 5 percent slopes. This soil is not extensive in the county. It is on gentle to moderate slopes and occurs

on prairie uplands, mostly near Westville. It is a deep, brownish, cherty soil that formed under prairie grasses.

This soil is best suited to native grasses or to tame pasture plants, such as a bermudagrass-legume mixture. Because it is somewhat excessively drained, this soil tends to be droughty. The content of chert makes cultivation difficult. Management of the soil in this capability unit is discussed further in the section "Management of Soils for Range."

CAPABILITY UNIT IVs-1

The only soil in this capability unit is Bodine very cherty silt loam, 1 to 8 percent slopes. It is a brownish, very cherty, strongly sloping to gently sloping, forested soil. It occurs in large areas throughout the county but mostly in the northern half. Because it is well drained to excessively drained and has rapid or very rapid permeability, this soil tends to be droughty. Also, it contains a large amount of chert that makes cultivation difficult (fig. 17).

The original cover consisted of mixed hardwoods and some pines. When cleared of timber and brush, this soil is one of the best in the county for strawberries. Truck crops are grown occasionally, but they are not generally grown for more than 2 years after the soil is cleared. Droughtiness, a high chert content, brush, and the loss of organic matter are the main problems.

After the yield of strawberries declines, tame pasture, woodland, or range should be established on this soil to keep it from growing up in brush and weedy plants. Management of this soil is discussed further in the subsections "Use of Soils for Woodlands" and "Management of Soils for Range."

CAPABILITY UNIT Vw-1

In this capability unit is Gravelly alluvial land, a miscellaneous land type. It is frequently flooded and consists mostly of gravel beds that contain very little soil. Streambanks and channels also make up part of this land type, and a few low bottoms of loamy and gravelly loam soils were included in mapping.

No areas of Gravelly alluvial land are suitable for cultivation. Willows and other water-tolerant trees that grow along streams and gravel bars provide browsing, and the few low bottoms, which contain more soil than the gravelly areas, can be used for tame pasture.

CAPABILITY UNIT VIs-1

The only soil in this capability unit is Bodine stony silt loam, 5 to 15 percent slopes. It is a very stony or cherty, brownish, loamy soil. This soil is on steep to moderate slopes and occurs on the timbered or formerly timbered uplands.

Because of stoniness, steepness, and droughtiness, this soil is not suited to cultivated crops except strawberries and other special crops. Generally, strawberries are grown for 3 or 4 years. Then the soil is planted to tame pasture, woodland, or range. This practice helps to keep the soil from growing up in brush and weeds. Management of this soil is discussed further in the subsection

Figure 17.—**Newly planted strawberries on Bodine very cherty silt loam, 1 to 8 percent slopes.**

"Use of Soils for Woodland" and "Management of Soils for Range."

CAPABILITY UNIT VIIs-1

This capability unit consists of a single soil and a complex of soils. The soils of each of these two units formed from different kinds of parent material. They have severe limitations that restrict their use to woodland, wildlife, or range. They are—

Bodine stony silt loam, steep.
Hector complex.

Bodine stony silt loam, steep, occupies nearly 25 percent of the total land area in the county and is mostly in the northern half. It is on timbered or cutover uplands. It has slopes that range from 20 to 50 percent and average about 30 percent. This soil is a brownish, very stony or cherty silt loam. Because of steepness, stoniness, and droughtiness, it is not suited to cultivated crops.

The Hector complex makes up nearly 22 percent of the total area of the county and is mostly in the southern part. The soils in this complex are stony, sandy, and very shallow to shallow. Generally they have very steep slopes, which are excessively drained. Because of severe limitations, the soils of this complex are not suited to cultivated crops.

The management of the soils in this capability unit is discussed in more detail in the subsections "Use of Soils for Woodland" and "Management of Soils for Range."

CAPABILITY UNIT VIIs-2

This capability unit consists of an undifferentiated group of Sogn soils. These soils are relatively inextensive and occur in scattered areas throughout the county, generally below soils of the Hector complex.

In most places the Sogn soils have strong slopes, but in some they have gentle slopes. The soils are dark-colored, clayey, and very shallow. They average about 7 to 8 inches thick over limestone bedrock. Runoff is medium to rapid, and moisture storage is limited by the small volume of soil that is among the many limestone outcrops and flagstones. Because of these severe limitations, Sogn soils are not suitable for cultivated crops. They are best used for range. Their management is discussed further in the subsection "Management of Soils for Range."

Yield predictions [6]

Predictions of yields of the principal crops and fruits and annual gains in beef per acre on tame pasture are listed in table 6. Estimates of gains in beef per acre are based on the proper use of pasture by animals from April through November, or about 8 months. Estimates were not made for soils that normally are not considered suitable for cropland. Crop failures, or years of no yield, are included in the yield averages.

The estimates are based on data from fertility studies, crop variety tests, and grazing trials by the Oklahoma Agricultural Experiment Station, and on yield and management records of farmers. These estimates can be used by a farmer to (1) compare his yields with the actual long-term yields that can be expected from each soil, or mapping unit; (2) learn the relative productivity of each mapping unit for a specified crop or fruit; and (3) compare his yields with increases that could be expected through improved management.

In columns A are the estimates of yields under customary, or prevailing, management. It is the management used by many farmers in the county. Customary management normally includes (1) a suitable rate of seeding, a suitable date of planting, and an efficient method of harvesting; (2) control of weeds, insects, and diseases; (3) use of terraces and contour farming where necessary; (4) use of small amounts of fertilizer. The estimates of gains in beef in column A are for animals grazing bermudagrass pasture under prevailing management.

In columns B are estimates of yields under the best practical management, or improved management. Improved management is designed to offset the limiting factors of production that are common to all soils, such as periodic drought, weeds, and insects, as well as to specific limitations that apply to particular soils. For instance, yields may be greatly increased on some soils by the use of adequate amounts of fertilizer or lime, or both; on other soils by surface drainage; and on still others by the kind of cropping or management practices that conserve moisture and topsoil. Estimates of gains in beef in column B are for animals grazing on a grass-legume pasture that has received a moderate amount of fertilizer.

Normally, improved management should include all the practices listed under customary management plus the following: (1) use of adapted, high-yielding varieties of crops, pasture, and fruit; (2) use of fertilizer and lime as indicated by soil tests and applied by approved methods; (3) use of surface drainage where needed; (4) management of crop residue; (5) use of tillage that controls erosion, improves tilth, increases infiltration, and enhances emergence of seedlings; and (6) use of a cropping system that fits the specific soils, as well as the operator's goal. Improved management for fruit also includes an effective spraying program, a good field location, and good varieties. Improved management of pasture requires special attention to the following: (1) distribution of salt and water to insure uniform grazing, (2) cross fencing that permits deferred or rotation grazing, and (3) careful control of brush. Specific erosion control practices are suggested for each soil in the subsection "Management by Capability Units."

Use of Soils for Woodland [7]

The original forest of Adair County probably occupied more than 251,000 acres, or about 69 percent of the total area. With the shift from forest to cultivation, woodlands were cleared to plant crops. Heavy cutting, burning, and grazing prevented or delayed regrowth of trees. The result was a shortage of good sawtimber. Stands of vigorous young trees were reduced both in number and in volume far below that which the soils could support. Without the forest to retard runoff on sloping land, soil erosion increased. Therefore, large amounts of gravel washed downslope onto cropland, which was alternately subject to flood and low water stages.

[6] ROY SMITH and RUEL BAIN, soil scientists, Oklahoma State University, assisted in writing this subsection.

[7] CHARLES P. BURKE, woodland conservationist, Soil Conservation Service, assisted in writing this subsection.

TABLE 6.—*Predictions of average acre yields of principal crops and fruits and annual gains for beef*

[Yields in columns A are expected under customary management; yields in columns B are expected under improved management. Absence of yield indicates crop seldom is grown on the soil specified or is not suited to it]

Soil	Capability unit	Wheat		Oats		Corn		Forage sorghum [1]		Alfalfa	Tame pasture		Beans	Straw-berries	Apples	Peaches
		A	B	A	B	A	B	A	B	B	A	B	B	B	B	B
		Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Tons*	*Tons*	*Tons*	*Lbs. of beef*	*Lbs. of beef*	*Tons*	*Qt.*	*Bu.*	*Bu.*
Bodine stony silt loam, 5 to 15 percent slopes	VIs-1	----	----	----	----	----	----	----	----	----		----	----	2, 760	----	----
Bodine stony silt loam, steep	VIIs-1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Bodine very cherty silt loam, 1 to 8 percent slopes	IVs-1	----	----	----	----	----	----	----	----	----	100	200	----	2, 760	----	----
Craig cherty silt loam, 1 to 5 percent slopes	IVe-3	12	18	23	35	20	30	2. 0	2. 8	----	125	225	----	----	----	----
Dickson cherty silt loam, 0 to 3 percent slopes	IIIs-1	12	18	20	34	23	36	2. 0	3. 0	----	125	225	2. 0	2, 760	180	120
Dickson silt loam, 1 to 3 percent slopes	IIe-2	16	23	26	42	27	40	2. 4	3. 4	----	150	250	2. 2	----	180	120
Etowah gravelly silt loam, 1 to 3 percent slopes	IIe-2	17	24	28	44	28	46	2. 6	3. 5	2½	160	300	2. 1	2, 760	180	120
Etowah silt loam, 0 to 1 percent slopes	I-2	21	30	33	50	33	52	3. 0	4. 0	3	200	350	2. 2	----	180	120
Etowah silt loam, 1 to 3 percent slopes	IIe-2	21	30	33	50	31	48	2. 7	3. 7	2¾	175	325	2. 2	----	180	120
Etowah and Greendale soils, 3 to 8 percent slopes	IVe-2	10	16	20	32	----	----	1. 4	2. 0	----	125	250	1. 6	2, 640	150	100
Gravelly alluvial land	Vw-1	----	----	----	----	----	----	----	----	----	125	300	----	----	----	----
Hector complex	VIIs-1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Hector-Linker fine sandy loams, 1 to 5 percent slopes	IVe-1	11	17	18	28	----	----	1. 7	2. 8	----	100	225	1. 5	2, 640	150	100
Huntington gravelly loam	IIw-1	18	14	27	41	38	47	2. 0	3. 0	----	150	300	1. 5	----	----	----
Huntington silt loam	I-1	23	29	33	47	46	55	3. 0	4. 0	3½	250	400	2. 0	----	----	----
Jay silt loam, 0 to 2 percent slopes	IIe-2	22	30	33	50	33	50	2. 7	3. 7	3	200	350	2. 0	----	----	----
Lawrence silt loam	IIs-1	15	23	25	40	25	38	2. 3	3. 3	----	125	225	----	----	----	----
Linker fine sandy loam, 1 to 5 percent slopes	IIIe-2	15	23	23	37	21	37	2. 0	3. 0	----	125	275	1. 8	2, 640	180	120
Linker fine sandy loam, 3 to 5 percent slopes, eroded	IIIe-4	12	20	20	34	----	----	1. 7	2. 8	----	100	250	----	----	150	100
Linker loam, 3 to 5 percent slopes	IIIe-2	18	26	25	41	23	39	2. 4	3. 3	----	150	300	1. 8	----	180	105
Linker loam, 3 to 5 percent slopes, eroded	IIIe-4	14	21	21	35	----	----	----	----	----	140	275	----	----	160	100
Osage clay loam	IIIw-2	14	17	25	36	22	34	2. 5	3. 0	2	150	250	----	----	----	----
Parsons silt loam, 0 to 1 percent slopes	IIs-1	18	28	28	39	23	33	1. 8	2. 6	----	100	200	----	----	----	----
Sogn soils	VIIs-2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Summit silty clay loam, 0 to 1 percent slopes	I-3	24	30	30	45	30	40	2. 3	3. 0	2¾	175	300	----	----	----	----
Summit silty clay loam, 1 to 3 percent slopes	IIe-1	22	28	27	42	27	37	2. 0	2. 7	----	150	275	----	----	----	----
Summit silty clay loam, 3 to 5 percent slopes	IIIe-1	18	24	22	37	22	32	1. 5	2. 2	----	125	250	----	----	----	----
Summit silty clay loam, 3 to 5 percent slopes, eroded	IIIe-3	14	19	20	34	----	----	----	----	----	100	200	----	----	----	----
Taft silt loam	IIIw-1	----	15	----	30	----	30	----	2. 5	----	100	200	----	----	----	----
Taloka silt loam, 0 to 1 percent slopes	IIs-1	20	31	31	44	26	39	1. 9	2. 7	----	125	225	----	----	----	----

[1] Yield of sorghum is given for ovendry weight.

Absentee owners have large holdings of woodland in the county. About 15 percent of the total acreage is owned by Indians and is under the jurisdiction of the U.S. Department of Interior. At present, industrial forest companies do not own any woodland in the county. Except for the land owned by Indians, or "restricted land," there is no State or Federal ownership of woodlands. Most privately owned holdings are less than 5,000 acres, and the average is less than 500 acres. Many holdings are small.

Recognition of the importance of woodlands to the economy, however, has spurred local interest in forest conservation. Technical assistance has been provided by the Soil Conservation Service for the management of more than 57,000 acres in the Sallisaw Creek Watershed.

The soil survey report can be used as a guide in

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determining the suitability of soils for woodland. A close relationship exists between the kind of soils on a site and the kind and quality of trees it supports. Some soils are associated with high-producing forests of good quality; other soils with low-producing forests of poor quality. A knowledge of the soils can supply the answer to many questions of landowners who are considering tree production. The soil survey provides information helpful in judging whether idle, brushy land will justify the cost and effort involved in converting the land to trees. The information will also be helpful in determining whether a small forest, postlot, or woodlot, if given appropriate management, will provide extra farm income.

Forests of the county

Two major forest types are represented in the county. They are (1) the oak-hickory type in which shortleaf pine constitutes less than 25 percent of the total stand, and (2) the oak-pine type in which shortleaf pine constitutes between 25 and 50 percent of the total stand. A large area of the oak-hickory type forest in the Ozark Plateau area of Oklahoma contains no pine in the mixture. The southern part of Adair County produces little or no shortleaf pine, and has only limited areas of commercial hardwoods.

Soils suitable for woodland

Nearly all the shortleaf pines in the county thrive on the cherty soils or soils derived from cherty rocks of the Ozark Plateau, such as those in the Bodine, Dickson, Etowah, and Greendale soil series. The soils on which shortleaf pines are native and which are suitable for their production include (1) Bodine stony silt loam, steep; (2) Bodine stony silt loam, 5 to 15 percent slopes; (3) Bodine very cherty silt loam, 1 to 8 percent slopes (fig. 18); (4) Dickson cherty silt loam, 0 to 3 percent slopes; (5) Dickson silt loam, 1 to 3 percent slopes; and (6) Etowah and Greendale soils, 3 to 8 percent slopes.

Interpretations for the soils suitable for shortleaf pine are given in table 7. The average site indexes shown in this table were obtained by measuring trees in stands growing on these soils. Site index, which is the average height in feet of dominant trees growing in a well-stocked stand at 50 years of age, is commonly accepted as an indication of potential soil productivity. Also in this table are the relative soil ratings in terms of *slight*, *moderate*, *severe*, and *very severe* for important hazards and limitations that need to be considered in management.

Figure 18.—**Shortleaf pine, 3 years old, on Bodine very cherty silt loam, 1 to 8 percent slopes. Maximum height of trees is 7 feet or more and the average is about 4 feet.**

TABLE 7.—*Interpretations for six soils suitable for shortleaf pines*

Soil type and map symbol	Average site index [1]	Seedling mortality	Plant competition	Equipment limitation	Erosion hazard	Windthrow hazard	Insect and disease hazard
Dickson silt loam, 1 to 3 percent slopes (DcB). Etowah and Greendale soils, 3 to 8 percent slopes (EtD).	57	Slight to moderate.	Moderate to severe.	Slight to moderate.	Slight to moderate.	Slight to moderate.	Moderate to severe.
Dickson cherty silt loam, 0 to 3 percent slopes (DkA).	54	Moderate to severe.	Moderate to severe.	Moderate to very severe.	Slight to moderate.	Slight to moderate.	Moderate to severe.
Bodine very cherty silt loam, 1 to 8 percent slopes (BdD). Bodine stony silt loam, steep (BsF). Bodine stony silt loam, 5 to 15 percent slopes (BoE).	48	Severe to very severe.	Very severe	Moderate to severe.	Slight to moderate.	Slight to moderate.	Moderate to severe.

[1] Site index ratings are tentative and subject to revision.

Site index can be converted to units of growth and yield by using table 8.

TABLE 8.—*Stand and yield information per acre for shortleaf pine for site index classes of even-aged stands* [1]

[Absence of data indicates that trees of the specified size are not used for specified purpose]

Site index	Age	Average diameter, breast high	Trees per acre before thinning	Volume per tree		Total merchantable volume	
				Board feet (Doyle)	*Cords (Standard)*	*Board feet (Doyle)*	*Cords (Standard)*
	Years	*Inches*	*Number*				
50	18	6	436	------	0.028	--------	12.20
	27	8	303	------	.070	--------	21.21
	36	10	222	------	.130	--------	28.86
	45	12	170	40	------	6,800	------
	54	14	134	80	------	10,720	------
	63	16	109	128	------	13,952	------
60	16	6	436	------	.032	--------	13.96
	24	8	303	------	.078	--------	23.64
	32	10	222	------	.140	--------	31.08
	40	12	170	44	------	7,480	------
	48	14	134	87	------	11,658	------
	56	16	109	140	------	15,260	------

[1] Adapted from volume, yield, and stand tables for second-growth southern pines. U.S. Dept. Agr. Misc. Pub. No. 50.

In table 7, seedling mortality refers to the potential loss of either natural or planted seedlings because of unfavorable soil conditions. A severe or very severe rating indicates that natural regeneration is unreliable. Planting may be necessary to obtain an adequate stand. In places it may be necessary to plant more than the normal number of seedlings per acre to help offset the unfavorable soil conditions. Plant competition refers to the probable hazard of obtaining an adequate stand of desired tree species because of competition from undesirable trees and brush on the specified soil. The severity of this hazard may be increased on any soil by overcutting, by fire, and by harmful grazing. Equipment limitation shows the relative influence of soil characteristics that limit the use, seasonally or all year, of equipment normally used in woodland establishment or harvest. Steepness, rockiness, or excessive wetness are examples. Erosion and windthrow hazards are not serious on the forest soils of Adair County; nevertheless, relative ratings are shown in table 7 for the six soils. Insect and disease hazards may not be directly related to soils in this area, but the ability of trees to overcome damage by them is related to soil characteristics that influence tree vigor and growth.

Dickson silt loam, 1 to 3 percent slopes, is a permeable soil and is used largely for cultivated crops and tame pasture. Only a small acreage is in pine, but, as shown in table 7, the average site index is 57 feet. Etowah and Greendale soils, 3 to 8 percent slopes, also have an average site index of 57 feet. These are the most productive soils for woodland in Adair County. They formed mostly in stream alluvium and are permeable and friable. Their use has been shifted from forest to tame pasture and to cultivated crops.

Dickson cherty silt loam, 0 to 3 percent slopes, has an average site index of 54 feet and is intermediate in productivity for woodland. Problems of establishment and management of woodland are not extremely severe.

Bodine stony silt loam, steep, has an average site index of 47 feet for shortleaf pine, and both Bodine stony silt loam, 5 to 15 percent slopes, and Bodine very cherty silt loam, 1 to 8 percent slopes, have an average site index of 48 feet. These are the low pine-producing soils of the Ozark Plateau. Permeability is rapid. In many places these soils contain large amounts of chert or stone on moderate to steep slopes. Problems of establishment and management of woodland on these soils range from moderate to very severe.

The soils shown as suitable for shortleaf pine in table 7 also produce commercial hardwoods, mainly white oak, northern red oak, southern red oak, post oak, black oak, and black locust. Post oak and black oak are of secondary importance and are cut only for local use. Etowah and Greendale soils produce all the oaks listed here and, on the wetter areas, some sycamore, pin oak, maple, elm, pecan, and black walnut.

Hardwoods on north-facing slopes of Bodine soils are of better quality and grow more rapidly than those on the south-facing slopes. Fully stocked stands of pine are rare on northern slopes because of the shading and the vigorous competition from hardwoods. Pine trees thrive, however, in the full sun on south-facing slopes and without serious competition from hardwoods. In addition to the commercial hardwoods that grow on the northern slopes of soils in the Ozark Plateau, some hardwoods grow on other soils on uplands and on first and second bottoms. These are soils of the Lawrence, Etowah, Greendale, Taft, and Huntington series.

The principal species to consider for post-lot planting in Adair County are black locust and catalpa. Black locust can be planted on soils on the Ozark Plateau that are relatively free of stones. The soils in the county most generally suitable for black locust are (1) Dickson cherty silt loam, 0 to 3 percent slopes; (2) Dickson silt loam, 1 to 3 percent slopes; (3) Etowah gravelly silt loam, 1 to 3 percent slopes; (4) Etowah silt loam, 0 to 1 and Etowah silt loam, 1 to 3 percent slopes; (5) Huntington gravelly loam; (6) Huntington silt loam; (7) Jay silt loam, 0 to 2 percent slopes; and (8) all Linker soils.

Catalpa is more exacting in soil requirements than black locust. For catalpa, the soils should be level or nearly level, deep, permeable, and well drained, and they should not be subject to frequent flooding. The soils generally suitable for planting catalpa are (1) Dickson silt loam, 1 to 3 percent slopes; (2) Etowah silt loam, 0 to 1 percent slopes; and (3) Huntington silt loam.

Protection practices

In the past, control of forest fires has been the primary problem of woodland conservation and management in Adair County. The Oklahoma Forestry Division provides the county with forest fire protection if funds are available. Recent developments, however, are directing public attention to the ill effects to woodland of fire and uncontrolled grazing.

Common insects that can cause critical damage to shortleaf pine are the pine tip moth, prevalent in many shortleaf pine plantings, and the engraver (*Ips* spp.) beetle. The best safeguard against beetle infestation is the kind of management that helps to maintain a vigorous and healthy stand. Damage by fire and logging lowers resistance of pine and increases the chance of beetle infestation.

Wood industries and markets

In Stilwell there is a market for pine, cedar, and hardwood posts and poles and hardwood crossties. Currently, the pulpwood market for pine is not reliable because of the long shipping distance to mills. Several wood-processing plants outside the county, however, provide a market for timber (7).

One of the oldest and best established charcoal plants in Oklahoma is at Baron, about 7 miles north of Stilwell (fig. 19). Both hickory and oak wood are converted into charcoal in this plant. The charcoal is shipped to all parts of the United States. This industry provides a market for low-grade oak and hickory; thus, some income is derived from land clearing and forest weeding.

Use of Soils for Wildlife [8]

Most of Adair County is hilly and mountainous. Much of it is covered by an oak-hickory type of forest that has a wide variety of associated plants. The high rainfall, ample surface water, and numerous plant species make the county well suited to many kinds of wildlife. Limited cultivation, which is mostly in small blocks, helps to improve wildlife habitats.

Many kinds of wildlife are in the county. The most important are bobwhite, or quail, white-tailed deer, mourning doves, fox squirrels, gray squirrels, cottontail rabbits, and swamp rabbits. Minks, muskrats, opossums, striped skunks, little spotted skunks, coyotes, red and gray foxes, and raccoons exist in fairly large numbers. Ducks and geese stop over during their fall and spring migrations, and a few pass the winter on local ponds, lakes, and streams. There are also many beneficial kinds of songbirds and many kinds of hawks and owls.

The number of cottontail rabbits varies from year to year. During years when their number is high, they are hunted for food, particularly in the winter.

[8] JEROME SYKORA, biologist, Soil Conservation Service, assisted in writing this subsection.

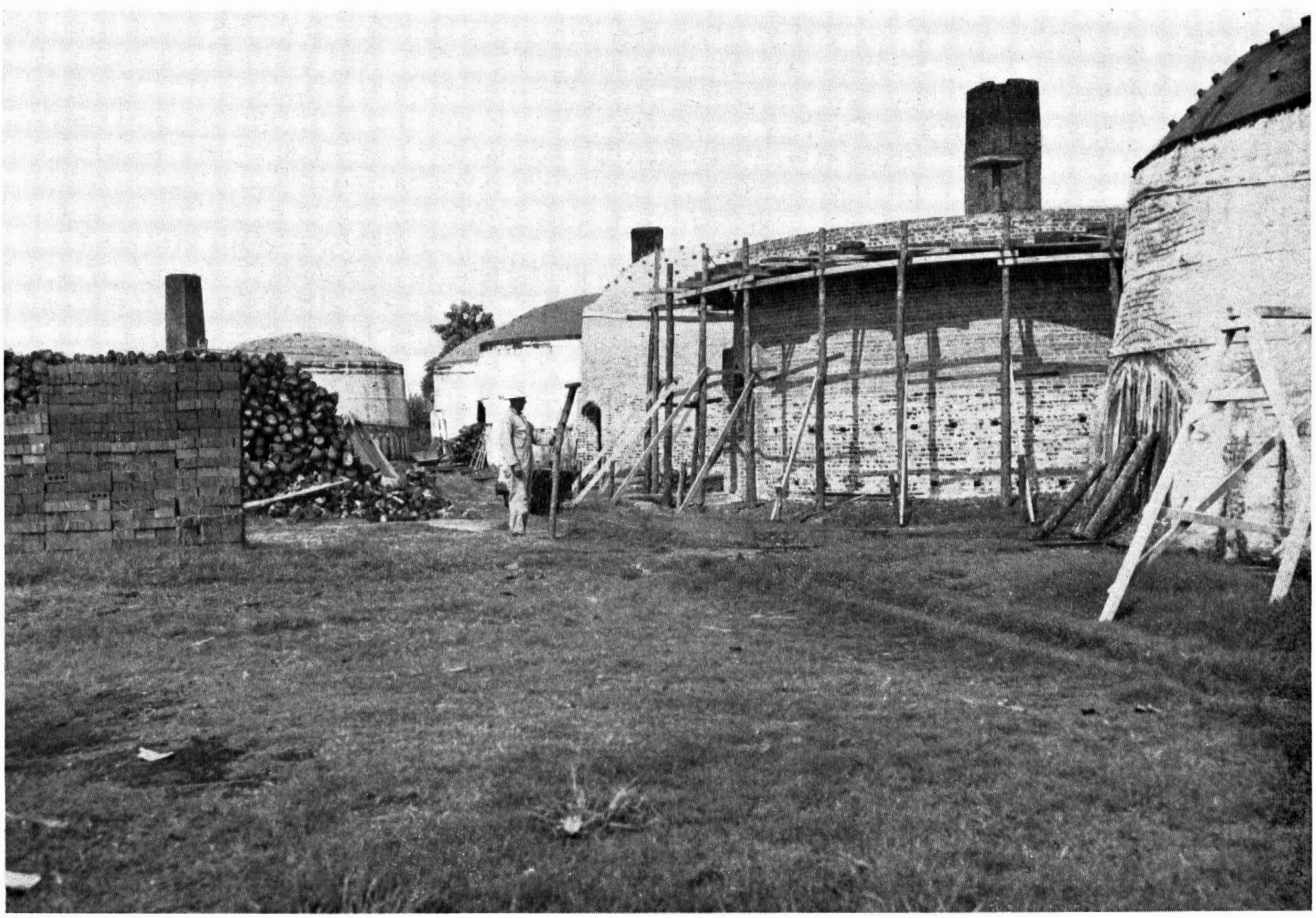

Figure 19.—**Large charcoal and briquette plant near Baron.**

Fishing is an inportant recreation in Adair County. It also furnishes much highly nutritious food for residents and tourists. The streams and lakes (fig. 20) are clear, fertile, and unpolluted, which makes them suitable for many kinds of fish. Largemouth bass, smallmouth bass, bluegill, green sunfish, channel catfish, flathead catfish, carp, bullhead, and buffalofish are the predominant fish in the county.

Kinds of wildlife

Bobwhite.—Although they occur over the entire county, bobwhite, or quail, (fig. 21) are found in greatest numbers in areas that are farmed in small fields. Their main food consists of seeds, insects, and green vegetation during the summer months and waste small grain and seeds during the winter. These game birds are particularly fond of grass seeds and weed seeds that occur in cropland, in pasture, in fence rows, and in wooded areas. Low, brushy cover, which the birds can use for nesting, brooding, and escaping from enemies, and a nearby supply of food provide a suitable habitat.

Mourning doves.—Mourning doves are migratory. Those that winter in the county usually have migrated from farther north. They can fly a considerable distance between water and food. In addition to the seeds of sorghum and small grain, doves eat seeds from sunflower, croton, and other weeds, which occur in fallow areas, cultivated fields, waste areas, and grasslands.

Deer.—White-tailed deer (fig. 22) are the only big game animals in the county. Until recently, their number was very low because of year-round hunting, diseases, parasites, numerous roving dogs, droughts, burned-over woodlands, and overgrazing of range by cattle. Deer prefer twigs, buds, seeds, fruits, shrubs, vines, legumes, and weeds as food. Overgrazing by livestock during periods of drought eliminates many grasses, legumes, and other choice foods. An excellent source of food, however, occurs when heavily wooded areas are cleared and a regrowth of many shrubs, young trees, weeds, and legumes follows.

The Cookson Hills State Game Refuge is in the southwest corner of Adair County. It is helping to increase the number of deer by providing protection and a reliable food supply throughout the year. The Oklahoma State Department of Wildlife Conservation is also providing an educational program on wildlife to gain support for their game refuge system.

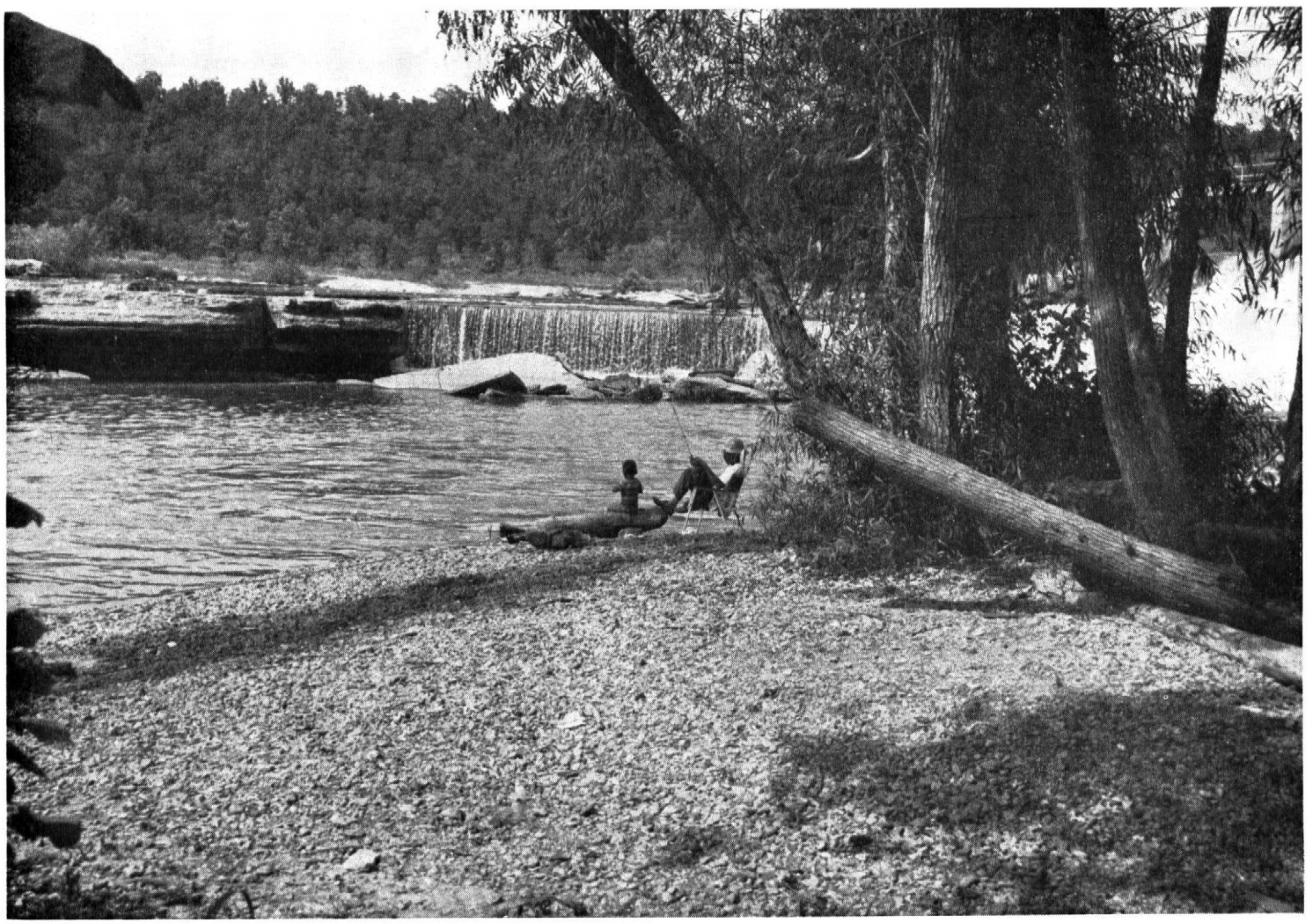

***Figure 20.*—Natural dam supplemented by a concrete dam forms Lake Francis, on the Illinois River near Watts. The lake is excellent for fishing.**

Figure 21.—**Bobwhite, or quail, are numerous in Adair County. (By permission of the Fish and Wildlife Service, U.S. Department of Interior.)**

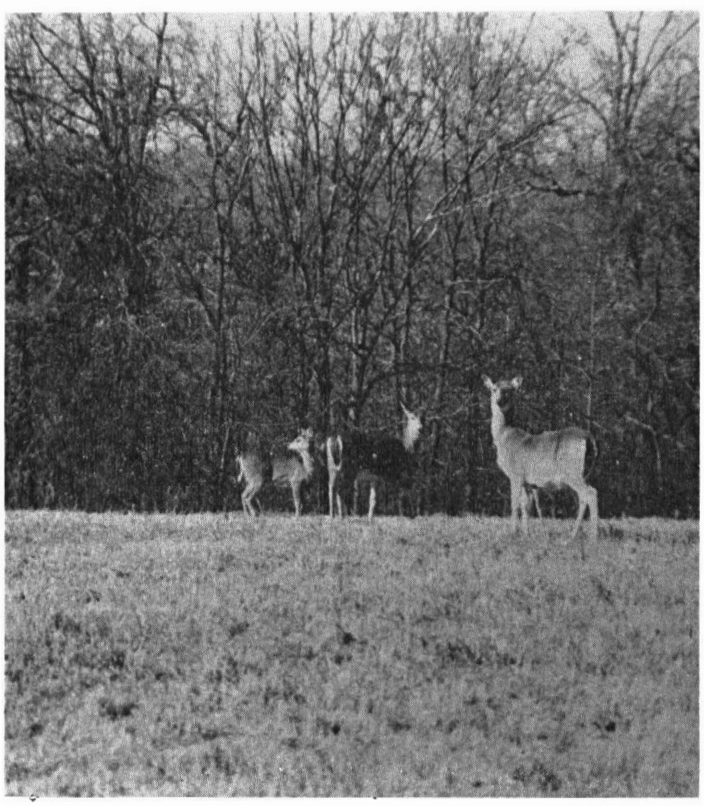

Figure 22.—**White-tailed deer graze in the Cookson Hills State Game Refuge.**

Squirrels.—Fox squirrels and the gray squirrels differ somewhat in their habitat requirements. The fox squirrels are usually able to live in almost any timbered area where there is enough food, such as berries, fruits, nuts, and acorns. Hollow, or den, trees where their young can be raised safely are necessary. The gray squirrels can use the same habitat as the fox squirrels, but they prefer the densely wooded bottom lands where there are mature trees that produce acorns and nuts.

Predatory animals.—Bobcats, coyotes, and foxes generally are beneficial in controlling the number of rodents. The number of predatory animals fluctuates with the increase or decrease in the number of animals they feed on. These predatory animals are hunted with dogs.

Furbearers.—Raccoons and opossums require den trees in which to raise their young and to escape from their enemies. Food requirements for both are similar. Their food consists of a wide variety of fruits, nuts, berries, and insects. Raccoons particularly like the frogs, small fish, and clams that are in shallow ponds and streams.

Muskrats are mainly vegetarian. They make dens in the ground along the edge of streams or ponds. Their main foods are cattails, burreeds, and bulrushes. They also eat small numbers of fish, amphibians, clams, insects, and young birds.

The fur of mink is more valuable than that of any of the other furbearers in the county. These animals are therefore often sought by local trappers. Mink requires rodents, birds, toads, frogs, and fish for food. Slow-moving streams and other bodies of water are favored habitats.

Waterfowl.—Waterfowl, especially ducks, use the cover found along the edge of lakes and ponds. Some protection is also provided by the water itself. Mallard ducks feed on grain from fields. Geese eat almost any green forage, but they particularly like wheat.

Kinds of habitat

Bobwhite, or quail, usually benefit if a yearlong supply of food, such as weed seeds, legumes, corn, and sorghum, is provided near good cover. Disturbance of the soil along the edge of growing timber stimulates the growth of annual weeds and grasses that produce high-quality food. Overgrown fence rows and field borders provide cover and food, as well as a protected trail for the birds to move from place to place. Piles of loose brush along the edges of mature timber provide improved cover for both quail and rabbits.

Squirrels are encouraged by protecting trees in which they can make dens, and by planting nut and fruit trees.

Muskrats and ducks are attracted to large, fertile ponds that have a good growth of semiaquatic and aquatic plants, such as cattails and sago pondweed. Ducks are particularly fond of seeds produced around the edge of ponds. For maximum use of ponds by waterfowl, the water can be drawn down early in summer, and the soil along the shoreline can be planted to barnyard grass or various kinds of millet. Any natural shoreline plants that produce abundant seeds are also desirable for planting for duck food. When ducks start their southward migration, the water level should be raised to cover the seed to a depth of 2 to 15 inches.

Approximately 600 farm ponds have been built in Adair County, mainly for livestock water. Most of these

ponds, however, are stocked with fish, and if managed well, will produce largemouth bass, sunfish, bullhead, and channel catfish. Good management of farm fish ponds includes proper stocking, fertilizing to produce sufficient food, controlling undesirable pond weeds, and adequate harvesting of all species of fish to avoid overpopulating the pond.

Ponds that are built on loamy or sandy soils in a watershed that is eroded and gullied may become turbid. This may also occur if part of the runoff originates in roadside ditches. This turbidity impedes the growth of fish. Diversion of the more turbid water and planting the watershed in better cover will provide clear water for the pond. The addition of fertilizer and gypsum to the water is also beneficial.

The management of soils for deer is practical only on very large ranches or by a group of several landowners. Complete protection of deer from hunters and from dogs and protection of the range from severe overgrazing must be provided before a herd of deer can be established. Planting an adequate supply of small grain and legumes for food also helps. The minimum-sized area in which deer can be managed successfully is about 5,000 acres.

Management of Soils for Range [9]

Rangeland used as pasture consists mainly of native grasses, forbs, and shrubs that are valuable for forage and are of sufficient quantity to justify use of the range for grazing. In most places in the county, the smoother, deeper soils were plowed and used for cropland, and the rougher, steeper, or rocky areas were left in native pasture.

Much of the rangeland in Adair County is now producing below its capacity. The well-managed pastures and meadows contain a mixture of tall grasses composed principally of big bluestem, little bluestem, switchgrass, and Indiangrass, and numerous legumes and forbs. If pastures and meadows are managed well, these plants can be maintained.

In the following pages, range sites and condition classes are discussed. Also, the individual range sites are described, and the soils in each are listed. The yields of herbage produced on each site are estimated and listed in table 9. Finally, some practices of range management that apply to all range sites are discussed.

Range sites and condition classes

Range sites are distinctive kinds of rangeland that have different potentials for producing native, or climax, plants. Sites retain their potential capacity to reproduce the original plant community, unless the soils are severely altered physically. Nature is constantly working to restore the kind and amount of vegetation that originally grew on the site.

If the rancher knows the kind of range site, the kind of soils on the site, and the condition of the range, he can judge how well the range will produce forage and how it can be improved.

The soils in any one range site produce about the same kind and amount of climax vegetation. *Climax vegetation* is the combination of plants that grew originally on a site. It is generally the most suitable and the most productive vegetation for the site. Moreover, most plants in the climax vegetation are palatable and nutritious for grazing animals.

Animals are selective in grazing. If they have a free choice, they select the more palatable and nutritious plants. Without good range management, these plants decrease in number or are eliminated. They are, therefore, called *decreasers.* Consequently, the less palatable plants increase in number and are called *increasers.* If grazing is continued, the less palatable plants, or increasers, are thinned or eliminated. Then the undesirable plants, called *invaders*, replace the decreasers and increasers.

Ranchers estimate range condition to determine the approximate deterioration or improvement of the range. The ratings can be used as a guide for predicting the degree of improvement possible under good management.

Range condition is rated in terms of condition classes to express the relation of the existing vegetation to the original, or climax, vegetation. The ratings express the degree to which the present vegetation on any site departs in kinds or amounts from the climax. There are four range condition classes for each range site—*excellent*, *good*, *fair*, and *poor*.

A range is in *excellent condition* if 76 to 100 percent of the present vegetation is the same kind as that in the original stand; it is in *good condition* if the percentage is between 51 and 75; it is in *fair condition* if the percentage is between 26 and 50; and it is in *poor condition* if the percentage is 25 or less.

Plant composition is the basis for determining condition of the range site. It is determined by a visual estimate of the relative production, by weight, of the different species present. Condition class may be determined any day of the year. In pastures that are being grazed, an estimate should be made of how the present vegetation would appear after a rest of one growing season. This is the best guide. Condition class guides are kept current in the local work unit office of the Soil Conservation Service to help farmers and ranchers determine the condition of their range.

Descriptions of range sites

On the following pages the eight range sites in the county are described, and the soils on each site are listed. Also listed are the principal plants on the site and the plants that become abundant when the range is in poor condition.

Because they are primarily suited to woodland, the following soils and land types were not placed in range sites:

Gravelly alluvial land.
Huntington silt loam.
Huntington gravelly loam.
Lawrence silt loam.
Taft silt loam.

CLAYPAN PRAIRIE RANGE SITE

The only soil in this site is Parsons silt loam, 0 to 1 percent slopes. It has a silt loam surface layer and a very compact, clayey subsoil. The very slowly permeable subsoil restricts percolation of moisture and root growth.

[9] ALLEN MOSS and NEAL STIDHAM, range conservationists, assisted in writing this subsection.

Big bluestem, little bluestem, switchgrass, and Indiangrass grow on this range site. Silver bluestem, broomsedge, witchgrass, windmilligrass, and ragweed invade under misuse of the site.

LOAMY PRAIRIE RANGE SITE

The soils of this site are nearly level to moderately sloping. Internal drainage ranges from moderately rapid to very slow. This is a productive range site (fig. 23). The soils are—

Craig cherty silt loam, 1 to 5 percent slopes.
Jay silt loam, 0 to 2 percent slopes.
Summit silty clay loam, 0 to 1 percent slopes.
Summit silty clay loam, 1 to 3 percent slopes.
Summit silty clay loam, 3 to 5 percent slopes.
Summit silty clay loam, 3 to 5 percent slopes, eroded.
Taloka silt loam, 0 to 1 percent slopes.

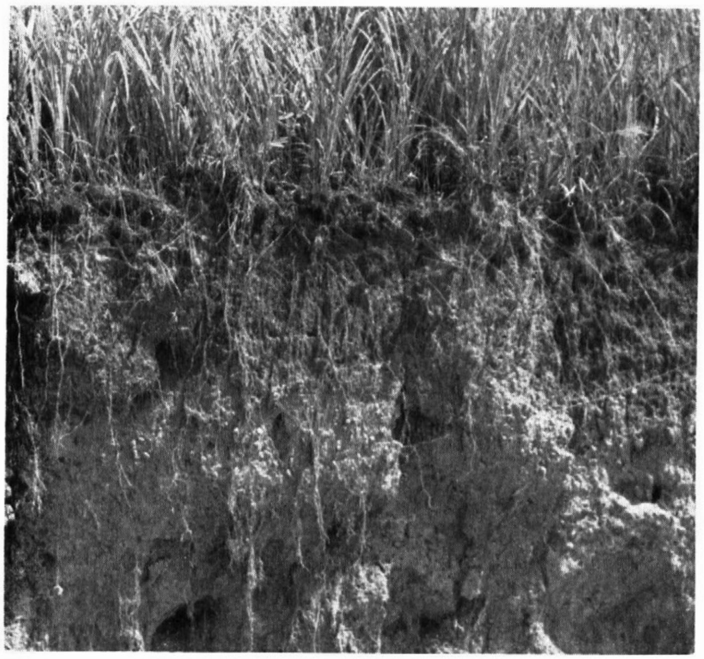

***Figure 23.*—A good cover of little bluestem, Indiangrass, and other native prairie grasses on Loamy Prairie range site. Root penetration is deep. Soil is Jay silt loam, 0 to 2 percent slopes.**

The principal decreaser plants on this site, when it is in excellent condition, are big bluestem, little bluestem, switchgrass, Indiangrass, gayfeather, ashy sunflower, and leadplant. When the site is in poor condition, the less desirable plants become abundant. They are jointtail, purpletop, dropseed, broomsedge, windmillgrass, silver bluestem, ragweed, and ironweed.

VERY SHALLOW RANGE SITE

Only the Sogn soils, which have gentle to strong slopes, are in this range site. The site includes pockets of deep to very shallow soils that developed from limestone. Some limestone flagstones are on the surface. Narrow bands of deeper soils occur in crevices in the bedrock. Production is usually low on this site.

The decreaser plants of this range site, when it is in excellent condition, are big bluestem, little bluestem, side-oats grama, compassplant, and willowleaf sunflower. When the range is depleted, plants that appear in abundance are side-oats grama, silver bluestem, broomweed, ragweed, beebalm, and pricklypear.

SANDY SAVANNAH RANGE SITE

The soils of this range site have a good moisture-holding capacity. They are deep and well drained. Tall grasses and woody plants grow well, and a highly productive range is possible under good management. The soils are—

Linker fine sandy loam, 1 to 5 percent slopes.
Linker fine sandy loam, 3 to 5 percent slopes, eroded.
Linker loam, 3 to 5 percent slopes.
Linker loam, 3 to 5 percent slopes, eroded.

Big bluestem, little bluestem, switchgrass, and Indiangrass originally grew on these soils. Oak, hickory, and other woody plants were cleared before cultivation began. Rough buttonweed, three-awn, broomsedge, splitbeard, and scrubby hardwoods now occupy most areas of this site that are no longer cultivated. Severe gullying and rilling of the eroded Linker soils have halted cultivation, and these soils are reverting to native plants (fig. 24).

***Figure 24.*—Field on Sandy Savannah range site that is reverting to native grasses after erosion stopped cultivation. The soil is Linker fine sandy loam, 3 to 5 percent slopes, eroded.**

SHALLOW SAVANNAH RANGE SITE

The soils of this range site are shallow to very shallow and occur on gentle to very steep slopes. Sandstone boulders and rock outcrops are common on soils of the Hector complex, and forage production is limited. Very little forage is produced on about 25 percent of the complex of soils. Hector-Linker fine sandy loams, 1 to 5 percent slopes, produce in most places a better quality and quantity of grasses than soils of the Hector complex. The soils are—

Hector complex.
Hector-Linker fine sandy loams, 1 to 5 percent slopes.

Hardwoods make up about 15 percent of the vegetation on this site. The principal climax grasses are little bluestem, big bluestem, Indiangrass, purpletop, and Canada wildrye. Grasses invading the site after misuse are splitbeard and broomsedge. Hardwood increasers are blackjack oak, post oak, red oak, hickory, and winged elm. Some shortleaf pine grows on south-facing slopes.

SMOOTH CHERT SAVANNAH RANGE SITE

The soils of this site are nearly level to steep, deep, and well drained. Commonly the surface layer is a silt loam or cherty silt loam, and the subsoil is a cherty silty clay loam. The subsoil may have a very low water-holding capacity and a small amount of plant nutrients because of the large volume of chert. The soils are—

Bodine stony silt loam, 5 to 15 percent slopes.
Bodine very cherty silt loam, 1 to 8 percent slopes.
Dickson cherty silt loam, 0 to 3 percent slopes.
Dickson silt loam, 1 to 3 percent slopes.
Etowah gravelly silt loam, 1 to 3 percent slopes.
Etowah silt loam, 0 to 1 percent slopes.
Etowah silt loam, 1 to 3 percent slopes.
Etowah and Greendale soils, 3 to 8 percent slopes.

Under proper management, good yields of big bluestem, little bluestem, Indiangrass, and purpletop can be expected on this site (fig. 25.) Trees that grow on this site are post oak, blackjack oak, elm, red oak, white oak, shortleaf pine, black walnut, and hickory. The principal woody increasers on range in poor condition are persimmon, ash, post oak, blackjack oak, and sassafras. Broomsedge, poverty oatgrass, and ragweed also invade along with the thick stand of brush.

STEEP CHERT SAVANNAH RANGE SITE

The only soil on this range site is Bodine stony silt loam, steep. It is a cherty, rapidly permeable to very rapidly permeable soil on steep to very steep slopes. It has rapid internal drainage and provides less moisture for plant growth than other soils with the same annual rainfall.

The yield of herbage on this site is limited by stoniness and a low water-holding capacity. Under good management, the decreaser plants are big bluestem, little bluestem, Indiangrass, slender lespedeza, roundhead lespedeza, and tickclover. An open stand of post oak, red oak, blackjack oak, white oak, black walnut, and shortleaf pine may occur, and dogwood, huckleberry, and grape are common. When the site deteriorates, it is invaded by a brushlike growth of blackjack oak, post oak, sassafras, and persimmon. Among the brush, broomsedge is intermixed with poverty oatgrass.

HEAVY BOTTOMLAND RANGE SITE

The only soil on this range site is Osage clay loam. It is nearly level, deep, poorly drained, very slowly permeable soil in clayey alluvium. It is subject to occasional flooding. This soil has a clay loam surface layer and a dense clay subsoil.

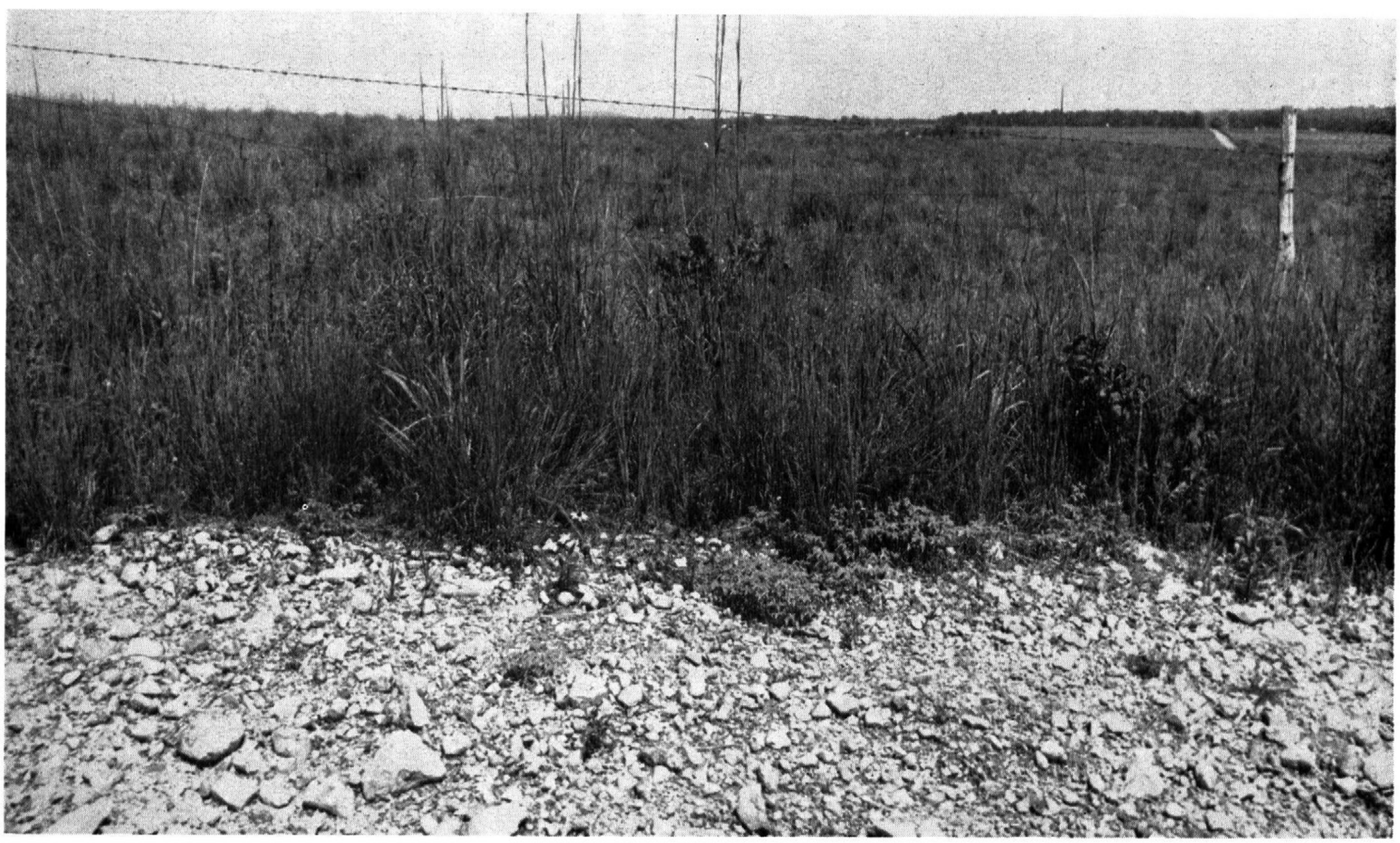

Figure 25.—Timber has been removed, and field is reverting to big and little bluestem. The soil is Bodine very cherty silt loam, 1 to 8 percent slopes.

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The yield of herbage is high when the site is not flooded and moisture is sufficient. Switchgrass, eastern gamagrass, prairie cordgrass, broadleaf uniola, and sedges are abundant forage plants. Trees that grow on this site are elm, oak, ash, walnut, and pecan. Poison-ivy and grape are common woody plants. When this range site is in poor condition, increasers are giant ragweed, sumpweed, goldenrod, aster, sedges, rushes, and scrubby hardwoods.

Estimated yields of range sites

Research and other data on the actual production of herbage on soils and range sites in the county are limited. In order to give operators a better understanding of the productivity of range sites, estimates of yields are provided in table 9 for range sites by condition classes and for old fields on the range sites.

These estimates are on the basis of limited studies of clippings made during favorable years. For unfavorable years, the estimates should be reduced by 50 percent. The estimates represent the total herbage, which was clipped at ground level and air dried.

The amount of usable forage is much higher for sites in excellent and good condition than for sites in fair and poor condition. The herbage on sites in fair and poor condition and in old fields is made up primarily of poor-quality grasses and weeds. In most places old fields that have been cleared of brush yield more herbage than the sites on savannahs that are in poor condition and have a dense cover of brush.

Normally, the actual amount of usable green forage or hay will be considerably less than that shown in table 9. If the site is managed so that one-half of the current growth is left each year, the animals may not consume half of the herbage produced. They may actually consume only about 25 to 35 percent of the current growth because of natural losses to rodents, to insects, by weathering, and from other causes.

TABLE 9.—*Estimated average acre yields of air-dry herbage*

Range site	Condition class				Old fields
	Excellent	Good	Fair	Poor	
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Claypan Prairie	5, 000	4, 000	3, 500	3, 000	2, 500
Loamy Prairie	6, 500	6, 000	3, 500	3, 400	3, 400
Very Shallow	3, 000	2, 750	2, 500	2, 000	(1)
Sandy Savannah	5, 000	4, 500	1, 500	750	3, 000
Shallow Savannah	4, 750	1, 250	1, 250	500	2, 500
Smooth Chert Savannah	[2] 5, 000	4, 500	2, 500	1, 000	3, 500
Steep Chert Savannah	[2] 4, 500	3, 000	1, 500	3, 250	3, 000
Heavy Bottomland	7, 000	5, 000	3, 500	3, 000	3, 000

[1] No old fields are on Very Shallow range site.
[2] Crown canopy of brush is not more than 15 percent.

Principles of range management

Good range managment includes grazing at an intensity that maintains adequate cover for the protection of the soil and maintains or improves the quantity and the quality of desirable plants. Good grazing practices are the most important part of range management. A vigorous, healthy stand of the highest producing grasses can be maintained if enough forage remains unused at the end of the growing season (fig. 26). According to experienced ranchers, about one-half of the annual plant production, by weight, can be removed by grazing without lowering the yield or reducing the stand.

Repeated or prolonged overuse of range removes too many green leaves, thereby reducing the ability of the plants to produce the deep roots, seeds, and new shoots necessary for reproduction and maintenance of the stand.

Operators who are familiar with their range sites and the main grasses generally recognize signs of improvement or decline in range condition and adjust management to fit the condition. Native grasses developed under grazing, and moderate grazing of these grasses does not cause deterioration of the range.

Specific information about the stocking of rangeland is not included in this report. Technical personnel of the local agricultural agencies assist ranchers to classify range sites and to estimate the condition of the range and the number of animals to stock.

In the following paragraphs, some important practices of range management in Adair County are discussed.

Deferred grazing.—Deferred grazing is a practice used to hasten the recovery of overgrazed range that has a sufficient number of decreaser plants. Without enough decreaser plants, the range may also need seeding. Deferred grazing should be started at the beginning of the growing season for native grass, usually about the first of April, and continued through October. This period gives the decreasers, which include big bluestem, little bluestem, switchgrass, Indiangrass, good legumes, and forbs, a chance to increase in number and vigor and to crowd out less desirable plants. Three months of deferred grazing, beginning in mid-July, allows plants to produce seed for harvest if the weather is favorable.

Range meadows.—In some areas of Adair County, native bluestem is cut annually for hay. Most meadows are on gently sloping soils that have no stones to hinder mowing and raking.

On the uplands one cutting late in June or early in July allows time for growth before frost. This regrowth helps to maintain a good, vigorous stand of the best kind of grasses. By contrast, a single cutting in August or September results in stemmy hay of low nutritive value, and repeated late annual mowing or double mowings reduce the vigor of the grass, as well as lower the quality of the hay.

The cutter bar of the mower should be adjusted to cut above the first joint of the grass, which is about 3 or 4 inches above the soil. Cutting at this height encourages regrowth immediately and hastens the recovery of the grasses. Almost all the food value of plants is in the green leaves.

Meadows that are mowed early in summer often produce forage that may be grazed in winter without damaging the stand. Light grazing can be done in winter if the soil is firm.

Range site and condition class are determined for range meadows by the same method as that used for native pastures.

Figure 26.—**A well-managed range on Smooth Chert Savannah range site. Native pasture consists of big bluestem and little bluestem.**

Range seeding.—Reseeding is needed on idle cropland that is being returned to pasture. Seeding is also needed on overgrazed range in poor condition that is not expected to return to a good stand of bluestem grasses after a reasonable period of deferred grazing. A mixture of big bluestem, little bluestem, switchgrass, and Indiangrass should be seeded (fig. 27). A clean-tilled seedbed is needed, though good results can be obtained by drilling the seed in sorghum stubble or by broadcasting. A high-yielding range of native grasses can be established by (1) preparing a good seedbed, (2) using good quality seed, (3) controlling weeds and brush, and (4) deferring grazing for at least two growing seasons.

Brush control.—If rangeland on sites that are naturally brushy are overused, a thick stand of brush often invades the weak, depleted stand of native grasses. Brush that is crowding out or suppressing the native grasses as a result of overgrazing can be controlled by foliage spraying and by deferred grazing for two grazing seasons. Returns from moderate grazing during the dormant, or winter, season help defray the cost of spraying, and such grazing does little damage to the grass.

Water and salt distribution.—Uniform grazing of the pasture is desirable. Grazing near the salting or watering places may be destructive to the range, even though grazing is light in distant parts in the same pasture. If this damage occurs, changing the locations of the salt may

Figure 27.—**Excellent stand of Indiangrass 2 years old on Loamy Prairie range site. Grass was seeded in a field that was formerly cultivated.**

help to obtain uniform grazing. Also, another pond or watering place in the pasture, along with periodic movement of salt, may distribute grazing successfully. Fencing is costly, but it can be used if changing the watering and salting places fails.

Engineering Uses of Soils [10]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, pipelines, building foundations, facilities for water storage, erosion control structures, drainage systems, and sewage disposal systems. The properties most important to the engineer are permeability to water, shrink-swell potential, compaction characteristics, soil drainage, texture, plasticity, and pH. The thickness of unconsolidated materials and topography are also important.

The information in this report can be used to—

1. Make soil and land use studies that will aid in selecting and developing sites for industrial, business, residential, and recreational uses.
2. Make preliminary estimates of the engineering properties of soils that will help in the planning of agricultural drainage systems, farm ponds, irrigation systems, terraces, waterways, and diversion terraces.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting locations for highways and airports and in planning detailed investigations at the selected locations.
4. Locate probable sources of gravel and other material for use in construction.
5. Correlate performance of engineering structures with soil mapping units, and thus develop information for planning that will be useful in designing and maintaining the structures.
6. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
7. Supplement the information obtained from other published maps, reports, and aerial photographs for making maps and reports that can be used readily by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

The report does not eliminate the need for on-site sampling and testing of soils for design and construction of specific engineering works. It should be used primarily in planning more detailed field investigations to determine the condition of the soil, in place, at the proposed site of construction.

Some of the terms used by the soil scientist may not be familiar to the engineer, and some terms may have a special meaning in soil science. Several of these terms are defined in the Glossary at the back of the report.

Engineering soil classification, interpretations, and soil test data

To be able to make the best use of the soil maps and the soil survey report, the engineer should know the physical properties of the soil materials and the condition of the soil in place. Tables 10, 11, and 12 summarize the physical properties and the suitability of the soils for engineering works.

In table 10 the soils of the county are listed and briefly described and estimates of their physical and chemical properties are given. The soil properties are described on the basis of a typical profile for each soil. The soil profile is divided into layers significant to engineering uses, and the thickness and depth of each layer is given in inches. A more complete description of profiles is given in the section "Formation, Classification, and Morphology of Soils."

In table 10 soil texture is described according to (1) the classification used by the U.S. Department of Agriculture (*11*); (2) the Unified classification system developed by the Corps of Engineers, U.S. Army (*17*); and (3) the system used by the American Association of State Highway Officials (AASHO) (*1*).

In the system used by soil scientists of the U.S. Department of Agriculture, the texture of the soil horizon (layer) depends on the proportional amount of the different sized mineral particles. The soil materials are classified as cobblestones, pebbles, sand, silt, and clay. Rarely does a soil consist of only one particle size, but a particle size may dominate a soil so that it exhibits the characteristics of material composed of that particle size. For example, a soil that consists of 40 percent clay is called *clay* and characteristically feels slick, sticky, and plastic when wet.

The texture of a soil is closely associated with its workability, fertility, permeability, erodibility, and other important characteristics. Representative textural groups from the finest to the coarsest are fine-textured soils (*clay*, *silty clay*, *sandy clay*); medium-textured soils (*loam*, *silt loam*, *very fine sandy loam*); and coarse-textured soils (*sand and loamy sand*).

In the Unified classification system, soils are identified on the basis of texture and plasticity and on their performance as material for engineering construction. The soil materials are identified as coarse grained, which are gravels (G) and sands (S); fine grained, which are silts (M); and clays (C). In this system clean sands are identified by the symbols SW and SP; sands with fines of silt and clay are identified by the symbols SM and SC; silts and clays that have a low liquid limit are identified by the symbols ML and CL; and silts and clays that have a high liquid limit are identified by the symbols MH and CH.

In the AASHO classification system, soils are classified according to their engineering properties, as based on performance in highways. In this system soil materials are classified in seven principal groups, designated as A–1 through A–7. The best material for road subgrade is gravelly material of high bearing capacity and is classified as A–1; the next best, A–2; and so on to the poorest, which is A–7. Within each group the relative engineering value of the soil material is indicated by a group index number. The range for the group index number is from 0 for the best material to 20 for the poorest. The group index is shown in parentheses after the group symbol in table 12.

[10] By WALTER L. MARTIN and W. E. HARDESTY, engineers, Soil Conservation Service.

In table 10 the column showing reaction indicates the estimated acidity or alkalinity of the soil horizons and is expressed in pH. A pH of 4.5 to 5.0 indicates that the material is strongly acid, and a pH of 9.1 or higher indicates the material is strongly alkaline.

The shrink-swell potential of soil material refers to the change in volume that results from a change in moisture content. It is based on the results of tests or the observance of other physical properties or characteristics of the material. In table 10 this potential is expressed as high, medium, and low. For example, the Summit soils have a high content of clay. Consequently, they swell when they are wet and shrink and crack when they dry. Therefore they have a high shrink-swell potential. In contrast, the Bodine soils contain much less clay, and chert makes up about half their volume. In Bodine soils a change in moisture content therefore causes little change in volume. These soils have a low shrink-swell potential.

A hydrologic grouping of soils is used along with other data to compute the amount of runoff from a watershed after a storm of some given or actual intensity and duration. Knowledge of soil profile characteristics has been used in placing the soils of the county into three hydrologic groups. The soils were grouped according to the system explained in the Soil Conservation Service Engineering Handbook, Supplement A, section 4. This system lists four hydrologic groups, but only three occur in Adair County. The groups range from open sands (lowest runoff potential, group A) to tight clays (highest runoff potential, group D). The groupings express the intake of water at the end of storms during which soils have been made wet and have swelled. Also needed to compute the amount of runoff from a watershed are data on land use and treatment.

Table 11 shows specific features of soils that affect their use for engineering. These features may affect the selection of a site, the design of a structure, or the application of practices for land treatment. The data in this table are evaluated on the basis of estimated data in table 10, of laboratory test data in table 12, of field experience, and of observed performance of soil material in engineering works. The practices listed in table 11 are those common in the county. Suitability ratings as a source of material for various uses are given, as well as undesirable features, but desirable features are also listed.

Normally, only the surface layer is rated for topsoil, since the suitability of a soil for topsoil material depends largely on the texture and depth of the surface layer. Good topsoil is material that can be worked into good physical condition for seeding or sodding, yet be resistant to erosion when used on steep slopes. The depth of suitable material determines the economic feasibility of collecting the material for use as topsoil.

None of the soils in the county are a suitable source of sand for engineering works.

All or part of the whole profile is evaluated as a source of gravel. To be suitable, the material must have a high percentage of gravel. Some material can be used as it comes from the pit; other material needs to be washed and graded. The rating of soils as a suitable source of gravel is based on the quality and quantity of gravel contained.

Every kind of soil material is used in road fill. Some soils, such as sandy clays and sandy clay loams, cause few problems when they are placed and compacted. Clays that have a high shrink-swell potential, however, require special compaction techniques and close control of moisture during and after construction. Sands compact well, but they are difficult to confine when used in a fill. The ratings in table 11 reflect the ease with which these problems can be overcome.

Soil samples for testing were taken, by horizons, from typical soils in eight soil series. The samples were from soils that have modal profiles. A modal profile is the most typical one for that soil as it occurs in the county. A summary of the test data is given in table 12. These data were supplied by the State of Oklahoma Department of Highways, Materials and Research Departments, and are the results of tests made according to standard procedures of the American Association of State Highway Officials (AASHO) (*1*).

The tests for liquid limit and plastic limit measure the effect of water on the consistence of the soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content, on a dry basis, at which the soil material changes from a semisolid to a plastic state. The liquid limit is the moisture content at which the material changes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and plastic limit. It indicates the range of moisture content within which a soil material is plastic.

As moisture leaves a soil, the soil shrinks and decreases in volume in proportion to the loss of moisture. As the loss continues, a point is reached where shrinkage stops, even though additional moisture is removed. The moisture content at which shrinkage stops is the shrinkage limit of the soil and is reported as the moisture content in relation to the ovendry weight of soil at the point where shrinkage stops.

Since clay is the major soil fraction that causes shrinkage, the shrinkage limit of a soil is a general index of clay content and will, in general, be a low number for soils that contain much clay. The shrinkage limit of sands that contain little or no clay, however, is close to the liquid limit and is considered insignificant. The shrinkage limit of sands that contain some silt and clay ranges from about 14 to 25, and the shrinkage limit of clays ranges from about 9 to 14. As a rule, the load-carrying capacity of a soil is at the maximum when the moisture content is at or below the shrinkage limit. Sands do not follow this rule, because they have a uniform load-carrying capacity within a wide range of moisture content, providing they are confined.

The shrinkage ratio of a soil is the volume change, resulting from drying the soil material, divided by the loss of moisture caused by drying. Theoretically, it is also the apparent specific gravity of the dried soil pat.

Volume change from field moisture equivalent (FME) is defined as the volume change, expressed as a percentage of the dry volume of the soil mass, when the moisture content is reduced from the FME to the shrinkage limit.

TABLE 10.—*Brief description of soils and their*

Map symbol	Soil	Description of soil and site	Depth from surface
			Inches
BdD BoE BsF	Bodine very cherty silt loam, 1 to 8 percent slopes. Bodine stony silt loam, 5 to 15 percent slopes. Bodine stony silt loam, steep.	Medium-textured soils containing about 50 percent chert, by volume; depth to cherty limestone bedrock varies widely but averages about 3 feet; rapid to very rapid internal drainage.	0–14 14–20 20–36+
CrC	Craig cherty silt loam, 1 to 5 percent slopes.	Medium-textured soil containing about 20 to 50 percent chert, by volume; depth to very cherty materials averages 14 inches; medium to rapid internal drainage.	0–11 11–26 26+
DkA DcB	Dickson cherty silt loam, 0 to 3 percent slopes. Dickson silt loam, 1 to 3 percent slopes.	Medium-textured soils containing 10 to 20 percent chert, by volume; depth to cherty limestone averages about 36 inches; medium to slow internal drainage. Similar to Dickson cherty silt loam, but surface layer has less than 10 percent chert.	0–10 10–34 34–44 44+
EoB	Etowah gravelly silt loam, 1 to 3 percent slopes.	Medium-textured soils containing about 15 percent gravel; volume of gravel increases with increasing depth; gravel bed at a depth of about 26 inches; medium internal drainage.	0–10 10–26 26–50+
EtD	Etowah and Greendale soils, 3 to 8 percent slopes.	Etowah part: Same as Etowah gravelly silt loam, 1 to 3 percent slopes. Greendale part: Cherty silt loam on foot slopes and alluvial fans.	------------ 0–16 16–60+
EaA EaB	Etowah silt loam, 0 to 1 percent slopes. Etowah silt loam, 1 to 3 percent slopes.	Medium-textured soils about 2 to 6 feet thick over gravel; medium internal drainage.	0–10 10–35 35+
Ga	Gravelly alluvial land. [1]	Gravelly alluvium, stream channels, and unconsolidated gravel; frequently flooded.	------------
Hc	Hector complex.	Moderately coarse textured, stony soils; bedrock at a depth of about 6 inches; rock outcrops common; rapid or very rapid internal drainage.	0–5 5–60
HlC	Hector-Linker fine sandy loams, 1 to 5 percent slopes.	Moderately coarse textured soils; bedrock at a depth of about 11 inches; medium to rapid internal drainage.	0–10 10–16
Hu	Huntington gravelly loam.	Alluvial gravelly soil that becomes more gravelly with increasing depth; stratified silt, sand, and gravel at varying depths; occasionally flooded; medium internal drainage.	0–8 8–25 25–60
Hn	Huntington silt loam.	Medium-textured soil containing less than 10 percent gravel; depth to gravel bed 40 inches or more; occasionally flooded; medium internal drainage.	0–30 30–72+
JaA	Jay silt loam, 0 to 2 percent slopes.	Medium- to fine-textured soil about 6 feet deep; underlain by chert and gravel; moderate to slow internal drainage.	0–24 24–44 44–60+
La	Lawrence silt loam.	Medium-textured soil; claypan at a depth of about 18 inches; chert bed at about 24 to 40 inches; slow internal drainage.	0–8 8–36
LkC LkC2 LnC LnC2	Linker fine sandy loam, 1 to 5 percent slopes. Linker fine sandy loam, 3 to 5 percent slopes, eroded. Linker loam, 3 to 5 percent slopes. Linker loam, 3 to 5 percent slopes, eroded.	Moderately coarse textured soils; depth to bedrock about 18 to 40 inches; medium internal drainage.	0–6 6–30 30–34+

[1] Physical properties variable.

estimated physical and chemical properties

Classification			Percentage passing sieve—			Reaction	Shrink-swell potential	Hydrologic soil group
USDA texture	Unified	AASHO	No. 4	No. 10	No. 200			
						pH value		
Very cherty silt loam	ML or CL	A-4	20–50	20–50	20–50	5.8–6.3	Low	
Very cherty light silty clay loam	CL	A-4 or A-6	5–20	5–20	5–20	5.1–5.5	Low	B.
Chert bed	CL	A-4 or A-6	2–5	2–5	2–5	4.5–5.5	Low	
Cherty silt loam	ML or CL	A-4	50–70	50–70	50–70	5.5–6.5	Low	
Very cherty silty clay loam	ML or CL	A-4	40–60	40–60	40–60	4.8–5.5	Low	C.
Chert bed	ML or CL	A-4	10–20	10–20	10–20		Low	
Cherty silt loam	ML or CL	A-4	70–90	70–90	60–80	5.0–6.0	Low	
Cherty silt loam or light silty clay loam.	CL	A-4 or A-6	20–50	20–50	20–50	5.1–5.5	Low	B.
Cherty silt loam	CL or GC	A-4 or A-6	20–40	20–40	20–40	5.1–5.5	Low	
Chert beds	GC	A-1 or A-2	2–5	2–5	2–5		Low	
Gravelly silt loam	ML or CL	A-4	60–80	60–80	60–80	5.5–6.0	Low	
Gravelly heavy silt loam	CL	A-4 or A-6	55–70	55–70	50–60	4.5–5.5	Low	B.
Bed of gravel and light silty clay loam.	GM or GC	A-2 or A-4	10–20	10–20	10–20	4.5–5.5	Low	
Cherty silt loam	ML or CL	A-4	60–75	60–75	60–70	5.1–6.0	Low	
Cherty sily loam	CL or GC	A-4	50–70	50–70	50–70	4.5–5.5	Low	B.
Silt loam	ML or CL	A-4	80–90	80–90	75–90	6.0–6.5	Low	
Gravelly silty clay loam	CL	A-4 or A-6	55–70	55–70	50–60	5.1–5.5	Low	B.
Gravelly silty clay loam	GM or GC	A-2 or A-4	10–20	10–20	10–20	5.1–5.5	Low	
Stony fine sandy loam	SM	A-4	83	78	44	5.6–6.5	Low	C.
Weathered sandstone and fine sandy loam.	GM or GC	A-4	70	63	44	5.1–5.6	Low	
Fine sandy loam	ML or CL	A-4	100	100	44–48	6.0–6.5	Low	C.
Fine sandy loam and weathered or solid sandstone.	GM or GC	A-4	70–75	60–75	40–50	4.8–5.6	Low	
Gravelly loam	ML or CL	A-4	50–80	50–85	50–85	6.0–6.5	Low	
Gravelly loam	ML or GM	A-4	40–70	40–75	40–75	6.5–7.0	Low	B.
Very gravelly loam	GM or GC	A-2 or A-4	24–45	25–45	25–45	6.5–7.0	Low	
Silt loam	ML or CL	A-4	96	96	63	6.0–6.5	Low to medium.	B.
Silt, sand, and gravel	GC	A-2 or A-1	43	42	26	6.5–7.0	Low	
Silt loam	ML or CL	A-4	100	100	75–90	5.0–6.0	Low	
Silty clay loam	CL	A-6	90–100	90–100	75–90	4.5–5.0	Medium to high.	C.
Clay, chert, and gravel	CL or CH	A-6 or A-7	70–90	70–90	70–90	4.5–5.0	Medium to high.	
Silt loam	ML or CL	A-4	100	100	75–90	5.5–6.5	Low	C.
Silty clay loam to silty clay	CL or CH	A-6 or A-7	100	75–90	75–90	5.0–5.5	Medium to high.	
Fine sandy loam	SM or ML	A-4 or A-2	100	100	40–60	6.3–7.0	Low	
Heavy loam to sandy clay loam	ML or CL	A-4 or A-6	100	100	60–80	5.5–6.0	Low to medium.	B.
Disintegrated sandstone and sandy clay.	CL	A-6	85–95	85–95	55–75		Low	

TABLE 10.—*Brief description of soils and their estimated*

Map symbol	Soil	Description of soil and site	Depth from surface
			Inches
Oc	Osage clay loam.	Moderately fine textured soil; depth to gravel bed about 3 feet; very slow internal drainage; floods occasionally.	0–12 12–21 21–36
PaA	Parsons silt loam, 0 to 1 percent slopes.	Medium-textured soil with a claypan at about 14 inches; depth to chert bed averages about 45 inches; very slow internal drainage.	0–14 14–46 46+
So	Sogn soils.	Moderately fine textured soil; many limestone rocks and ledge outcrops; solid limestone at a depth of about 7 inches; slow internal drainage.	0–7
SuA	Summit silty clay loam, 0 to 1 percent slopes.	Moderately fine textured soil; depth to bedrock about 50 inches; medium to slow internal drainage.	0–14
SuB	Summit silty clay loam, 1 to 3 percent slopes.		14–48
SuC	Summit silty clay loam, 3 to 5 percent slopes.		48–56
SuC2	Summit silty clay loam, 3 to 5 percent slopes, eroded.		
Ta	Taft silt loam.	Medium-textured soil; depth to gravel about 5 feet; very slow internal drainage.	0–22 22–56+
TkA	Taloka silt loam, 0 to 1 percent slopes.	Medium-textured soil; a claypan at a depth of about 25 inches; depth to bedrock averages about 6 feet; very slow internal drainage.	0–20 20–70

TABLE 11.—*Interpretation of*

Soils and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Gravel	Road fill	Highway location	Dikes or levees
Bodine stony silt loam (BoE, BsF).	Not suitable	Not suitable; stones too large.	Poor; lacks binder material.	Excavation difficult; rough terrain.	Not needed
Bodine very cherty silt loam (BdD).	Not suitable	Fair; suitable for surfacing local roads.	Fair; stable but limited binder material.	Steep slopes; excavation difficult because of chert.	Not needed
Craig cherty silt loam (CrC).	Not suitable	Not suitable	Good	Excavation difficult because of chert.	Not needed
Dickson cherty silt loam (DkA).	Fair to unsuitable.	Not suitable	Good	Chert bed at a depth of 3 to 4 feet.	Not suitable; high seepage potential.
Dickson silt loam (DcB).	Fair to good	Not suitable	Good	Chert bed at a depth of 3 to 4 feet.	Chert bed at about 3 to 4 feet.
Etowah gravelly silt loam (EoB). Etowah and Greendale soils (EtD).	Fair to poor; gravelly.	Good	Good	Features favorable	Not needed
Etowah silt loam (EaA, EaB).	Good to fair	Not suitable	Good	Features favorable	Not needed

physical and chemical properties—Continued

Classification			Percentage passing sieve—			Reaction	Shrink-swell potential	Hydrologic soil group
USDA texture	Unified	AASHO	No. 4	No. 10	No. 200			
						pH value		
Light clay loam	MH or ML	A-6 or A-7	100	100	90-100	5. 6-6. 5	Medium	D.
Clay loam	CL or CH	A-6 or A-7	85-95	85-95	85-95	5. 6-6. 5	High	
Clay	CH or MH	A-7	85-95	85-95	85-95	5. 6-6. 5	High	
Silt loam	ML or CL	A-4	100	90-100	85-95	5. 5-6. 0	Low	D.
Silty clay	CH	A-7	100	90-100	90-98	5. 3-5. 8	High	
Clay	CH	A-7	85-95	85-95	85-95	5. 1-5. 6	High	
Clay loam	ML or CL	A-6 or A-7	100	100	95-100	6. 1-6. 5	Medium	D.
Silty clay loam	CL or CH	A-7	100	100	90-98	6. 5-7. 0	Medium to high.	C.
Silty clay loam	CL or CH	A-7	100	100	90-98	6. 5-7. 0	Medium to high.	
Silty clay	CH	A-7	100	100	90-98	7. 0-8. 0	High	
Silt loam	ML or CL	A-4	100	100	75-90	5. 5-6. 5	Low	D.
Heavy silty clay loam	CL	A-6 or A-7	100	100	85-95	5. 7-6. 2	Medium to high.	
Silt loam	ML or CL	A-4	100	100	90-95	5. 1-6. 0	Low	D.
Light silty clay	CL or ML	A-7	100	100	90-95	5. 1-5. 5	High	

engineering properties of soils

Soil features affecting—Continued					
Farm ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
Too shallow and stony; high seepage.	Seepage; shallow soil restricts use.	Good natural drainage.	Suitable for strawberries and other special crops; irrigation water scarce.	Too shallow	Too shallow; droughty.
High seepage; shallow to chert bed.	High seepage; shallow soil restricts use.	Good natural drainage.	Suitable for strawberries and other special crops; irrigation water scarce.	Too shallow	Too shallow; droughty.
High seepage potential; about 2 feet to chert bed.	Seepage; few sites	Good natural drainage.	Irrigation water not available.	Too shallow	Too shallow; droughty.
High seepage potential; chert bed at a depth of 3 to 4 feet.	Fair; occasional seepage.	Good natural drainage.	Irrigation water scarce	Too shallow; flat slope; stony.	Too shallow; droughty.
Chert bed at a depth of 3 to 4 feet.	Low shrink-swell potential; does not crack when dry; stable.	Good natural drainage.	Soil will produce crops suitable for irrigation, but irrigation water scarce.	Soil properties favorable; no limitations.	Soil favorable for construction and vegetation.
Chert gravel at a depth of 2 to 3 feet.	Stable; low shrink-swell potential.	Good natural drainage.	Moderate permeability; soil will produce high-value crops.	Soil properties favorable on silt loam soils; much gravel in surface layer.	Soil favorable for construction and vegetation.
Chert gravel at a depth of 2 to 3 feet.	Stable; low shrink-swell potential.	Good natural drainage.	Cost of water high compared to benefits.	Soil favorable; no limitations.	Soil favorable for construction and vegetation.

TABLE 11.—*Interpretation of engineering*

Soils and map symbols	Suitability as source of—			Soil features affecting—	
	Topsoil	Gravel	Road fill	Highway location	Dikes or levees
Gravelly alluvial land (Ga).[1]					
Hector complex (Hc)	Not suitable; very shallow; stony in many places.	Not suitable	Poor to fair; limited material.	Rock ledges; very steep in places.	Not needed
Hector-Linker fine sandy loams (HlC).	Poor; erosive topsoil; stony in many places.	Not suitable	Good if slopes are stabilized.	Features favorable	Not needed
Huntington gravelly loam (Hu).	Fair; gravelly	Suitable at a depth of about 9 inches.	Good	Occasionally flooded	High seepage potential.
Huntington silt loam (Hn).	Fair; shallow to gravel.	Gravel available at a depth of 20 to 60 inches.	Good	Infrequently to occasionally flooded.	High seepage potential.
Jay silt loam (JaA)	Good to fair	Not suitable	Poor; medium to high shrink-swell potential; unstable when wet.	Unstable subsoil	Not needed
Lawrence silt loam (La)	Good to fair	Not suitable	Poor; medium to high shrink-swell potential; unstable when wet.	Imperfectly drained in depressions; unstable subsoil.	Not needed
Linker fine sandy loam (LkC, LkC2). Linker loam (LnC, LnC2).	Fair; easily eroded.	Not suitable	Fair; unstable when wet.	Slopes easily eroded	Not needed
Osage clay loam (Oc)	Poor to fair	Not suitable	Poor; high shrink-swell potential; unstable.	Occasionally flooded; plastic; poor internal drainage.	Unstable in high fill; cracks when dry.
Parsons silt loam (PaA)	Fair to poor; shallow surface layer; easily eroded.	Not suitable	Poor; unstable; high shrink-swell potential.	Poor internal drainage; plastic; high shrink-swell potential.	Not needed
Sogn soils (So)	Poor; very shallow to limestone.	Not suitable	Poor; limited material	Limestone bedrock at surface in places; steep slopes.	Not needed
Summit silty clay loam (SuA, SuB, SuC, SuC2).	Good	Not suitable	Poor; medium to high shrink-swell potential; unsuitable.	Unstable; plastic subsoil.	Not needed
Taft silt loam (Ta)	Fair to poor; easily eroded.	Not suitable	Poor; medium to high shrink-swell potential; unstable.	Unstable; plastic subsoil; poorly drained.	Not needed
Taloka silt loam (TkA)	Good to fair	Not suitable	Poor; high shrink-swell potential; unstable.	Unstable; plastic subsoil.	Not needed

[1] Materials too variable for interpretation.

properties of soils—Continued

Soil features affecting—Continued					
Farm Ponds		Agricultural drainage	Irrigation	Terraces and diversions	Waterways
Reservoir area	Embankment				
-------------------	-------------------	-------------------	-------------------	-------------------	
Shallow to rock-----	Shallow; depth limits use.	Good natural drainage.	Nonarable------------	Nonarable--------	Nonarable.
Limited depth------	Stable fill; few sites available.	Good natural drainage.	Low water-holding capacity; irrigation water expensive.	Too shallow; erosive.	Not needed.
Subject to flooding; rapid seepage; gravel below a depth of about 2 feet.	Material satisfactory; few sites available.	Good natural drainage.	Low water-holding capacity; requires frequent light applications; water generally available.	Not needed-------	Not needed.
Subject to flooding; high seepage; gravel below a depth of about 2 feet.	Material satisfactory; few sites available.	Good natural drainage.	High water-holding capacity; moderate intake rate; water generally available.	Not needed-------	Not needed.
Low seepage; ample depth.	Slow permeability; low shrink-swell potential.	Some drainage needed because of mounds.	Irrigation water scarce; adapted to corn and small grain.	Soil properties favorable; difficult to construct because of mounds.	Soil properties favorable for construction and vegetation.
Low seepage; ample depth.	Slow permeability; moderate erosion; stable.	Internal drainage slow; depressions need surface drainage.	Water not available; suitability for irrigation questionable.	Not needed-------	Not needed.
Variable depth to parent material.	Material good; slopes easily eroded; low shrink-swell potential.	Good natural drainage.	Water scarce; high water-holding capacity.	Highly erosive; terraces needed on sloping fields.	High erodibility.
Ample depth; very slow permeability; slow seepage.	Not needed---------	Very slow internal drainage; occasionally flooded; nearly level.	Very low infiltration rate; occasionally flooded.	Not needed-------	Location eliminates need.
Low seepage; ample depth; very slow permeability.	Fair erosion resistance; moderate shrink-swell potential.	Nearly level areas and depressions need surface drainage; very slow permeability.	No available water; very slow intake rate.	Not needed-------	Location eliminates need.
Too shallow--------	Very little borrow material; no sites available.	Good natural drainage.	Not needed; too shallow for cultivation.	Too shallow------	Too shallow.
Low seepage; limestone at a depth of 2 to 8 feet.	Stable; medium shrink-swell potential.	Good natural drainage.	Slow permeability; cost high compared to benefits.	Highly erosive----	Soil favorable for construction and vegetation.
Low seepage; chert, sandstone, and shale at average depth of 5 feet.	Stable; medium shrink-swell potential.	Nearly level areas need surface drainage.	Very slow permeability; adapted to improved tame pasture.	Soil properties suitable.	Soil favorable for construction and vegetation.
Low seepage; ample depth.	Stable; medium shrink-swell potential.	Nearly level areas need surface drainage.	Very slow permeability; adapted to tame pasture.	Soil properties suitable.	Soil favorable for construction and vegetation.

TABLE 12.—*Engineering test data for*

[Tests performed by Oklahoma Department of Highways in accordance with standard

Soil name and location	Parent material	Oklahoma report number	Depth	Horizon	Shrinkage		Volumetric change from field moisture equivalent
					Limit	Ratio	
			Inches				*Percent*
Dickson silt loam, 1 to 3 percent slopes: 1,000 feet E. of the SW corner, SE¼ sec. 8, T. 18 N., R. 26 E. (Modal.)	Cherty limestone.	SO 4063	0–9	A1	21	1.65	6
		SO 4064	9–22	B1	18	1.79	20
		SO 4065	28–36+	Bx	20	1.76	26
Etowah gravelly silt loam, 1 to 3 percent slopes: NW¼ sec. 26, T. 17 N., R. 25 E. (Modal.)	Alluvium (terrace).	SO 4057	0–10	Ap	22	1.66	6
		SO 4058	17–26	B2t	17	1.82	21
		SO 4059	26–50+	C	19	1.76	20
Etowah silt loam, 1 to 3 percent slopes: 300 feet E. of NW corner sec. 30, T. 18 N., R. 26 E. (Modal.)	Alluvium.	SO 4060	0–6	A1p	20	1.73	3
		SO 4061	11–30	B1	19	1.84	12
		SO 4062	42–56	B3	17	1.77	28
Hector complex (Hector component): 1,200 feet NE of SW corner, NE¼ sec. 16, T. 15 N., R. 26 E.	Sandstone (Atoka formation).	SO 4076	0–5	A1	24	1.53	20
		SO 4077	5–60	C1	17	1.86	11
Huntington silt loam: SW corner sec. 18, T. 15 N., R. 26 E. (Modal.)	Alluvium (flood plain).	SO 4072	0–6	Ap	16	1.79	25
		SO 4073	24–36	C	16	1.88	16
Linker fine sandy loam, 1 to 5 percent slopes: 1,000 feet W. of NE corner sec. 17, T. 15 N., R. 26 E. (Modal.)	Sandstone (Atoka formation).	SO 4069	0–6	Ap	15	1.84	5
		SO 4070	11–23	B21t	15	1.92	12
		SO 4071	23–30	B22t	13	1.96	38
Parsons silt loam, 0 to 1 percent slopes: 1,000 feet S. of NW corner sec. 32, T. 18 N., R. 26 E. (Modal.)	Clayey alluvium.	SO 4052	0–6	Alp	22	1.67	7
		SO 4053	14–46	B2t	12	1.95	60
Summit silty clay loam, 1 to 3 percent slopes: 1,500 feet E. of NW corner sec. 9, T. 17 N., R. 26 E. (Modal.)	Limestone and shale.	SO 4066	0–14	A1	18	1.77	42
		SO 4067	24–36	B2	11	2.00	74
		SO 4068	48–56	C	11	2.04	66

[1] Mechanical analyses according to the American Association of State Highway Officials Designation: T 88-57(*1*). Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of

The FME is the minimum content of moisture at which a smooth surface of undisturbed soil will absorb no more water in 30 seconds, when the water is added in individual drops. It is the moisture required to fill all the pores in sands and to approach saturation in cohesive soils that have not been disturbed.

The engineering soil classifications in table 12 are based on data obtained by mechanical analyses and by tests to determine liquid limit and plastic limit. Mechanical analyses were made by the combined sieve and hydrometer methods. Percentages of clay obtained by the hydrometer method are not suitable for determining textural classes of soils used by the U.S. Department of Agriculture.

Formation, Classification, and Morphology of Soils

In this section the relationship of the outstanding morphologic characteristics of the soils of Adair County to the factors of soil formation is discussed. Physical and chemical data are limited for these soils, and the discussion is correspondingly incomplete and general.

soil samples taken from 8 soil profiles

procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analysis [1]												Liquid limit	Plasticity index	Classification	
Percentage passing sieve									Percentage smaller than—					AASHO	Unified [2]
2 in.	1½ in.	1 in.	¾ in.	⅜ in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm				
-----	-----	-----	100	98	93	86	82	74	68	11	9	24	2	A-4(8)	ML.
-----	-----	-----	100	98	93	90	86	81	78	25	20	29	9	A-4(8)	CL.
100	95	94	93	88	81	76	73	69	65	27	22	33	9	A-4(7)	ML-CL.
-----	-----	100	97	91	80	73	71	65	61	14	10	25	3	A-4(6)	ML.
-----	100	97	94	83	72	65	62	59	54	21	17	31	10	A-4(5)	ML-CL.
-----	100	96	85	65	53	46	42	39	36	13	11	31	9	A-4(1)	GM-GC.
-----	-----	-----	-----	-----	-----	100	96	81	70	14	10	21	1	A-4(8)	ML.
-----	-----	-----	-----	-----	-----	100	99	90	83	30	24	28	9	A-4(8)	CL.
-----	-----	-----	-----	-----	-----	100	98	90	85	35	31	35	12	A-6(9)	ML-CL.
100	95	93	92	87	83	78	76	44	41	19	14	37	7	A-4(2)	SM.
100	95	92	88	78	70	63	61	44	40	15	11	22	5	A-4(2)	GM-GC.
-----	-----	100	99	97	96	96	95	63	60	27	21	31	9	A-4(6)	ML- CL.
[3] 95	92	73	64	49	43	42	40	26	23	12	10	27	9	A-2-4(0)	GC.
-----	-----	-----	-----	-----	-----	100	99	48	43	10	7	17	1	A-4(3)	SM.
-----	-----	-----	-----	-----	-----	100	99	66	62	25	19	22	6	A-4(6)	ML-CL.
-----	-----	100	99	96	93	90	89	62	60	35	32	38	17	A-6(8)	CL.
-----	-----	-----	-----	-----	-----	100	98	92	85	20	17	30	7	A-4(8)	ML-CL.
-----	-----	-----	-----	-----	-----	100	98	96	92	48	44	53	27	A-7-6(17)	CH.
-----	-----	-----	-----	-----	-----	100	99	93	88	42	36	43	13	A-7-5(10)	CL.
-----	-----	-----	-----	-----	-----	100	99	96	90	57	50	59	28	A-7-5(20)	MH-CH.
-----	-----	-----	-----	-----	-----	100	99	95	85	58	50	56	31	A-7-6(19)	CH.

grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils. Because material larger than about ¼ inch in diameter was discarded when the samples were taken, the percentages passing various sieves do not necessarily agree with those in table 10.

[2] SCS and Bureau of Public Roads have agreed to consider that all soils having plasticity indexes within two points from A-line are to be given a borderline classification. Examples of borderline classifications obtained by this use are GM-GC, ML-CL, and MH-CH.

[3] A 3-inch sieve passes 100 percent.

Also, in this section the soils are classified in higher categories, and their morphology, as shown by the soil profile, is given.

Factors of Soil Formation

Soil characteristics are the result of the interaction of the five factors of soil formation—climate, living organisms, parent material, relief, and time. The relative importance of each factor varies from one place to another. In some places one dominant factor may determine most of the soil properties (*15*). For example, in Adair County the Bodine and Hector soils developed on similar relief under the same kind of vegetation. They differ, however, in several characteristics because the Bodine soils formed in parent material derived from cherty limestone and the Hector soils in parent material derived from sandstone.

Climate

In Adair County the warm, humid, continental climate has been a dominant factor in soil formation. The average temperature and the distribution of rainfall are shown in table 4 in the section "Climate." The soils are warm enough for biological activity from about March to November. Freezing and thawing have little effect on

weathering and the formation of soils in this county because the soils are frozen for only short periods and to a depth of only a few inches. Partly because of the warm, humid climate, most of the soils are strongly weathered, leached, and acid and have moderate fertility.

Living organisms

Grasses, trees, shrubs, earthworms, and other forms of plants and animals live on and in the soil. They are active in the soil-forming processes. As they die, their bodies decay and add organic matter to the soil, which darkens the upper layer. The addition of organic matter improves the structure and physical condition of the soil. Vegetation provides shade, which reduces the loss of water from runoff, wind, and heat.

Many kinds of micro-organisms are needed in soils to change the remains of plants and animals into humus from which plants can obtain nutrients. These micro-organisms help to decompose plant residue and to hasten soil formation. They also affect the chemical reactions in the soil, and they convert plant nutrients into forms that are more readily available to higher plants.

Earthworms and small burrowing animals influence soil formation by mixing the soil materials. They help to keep plants supplied with minerals by bringing up material from the lower part of the solum and mixing it with the surface layer. The kind, number, and variety of plants and animals in and on the soil are determined largely by the climate.

Parent material

Most of the soils in the northern part of Adair County developed from cherty limestone of Mississippian age. The cherty Bodine and Dickson soils are the principal examples. Soils in the southern part of the county formed mainly from Atoka sandstone of Middle Pennsylvanian age. They consist mostly of the Hector and Linker soils. Huntington soils, which occur on bottoms throughout the county, formed in materials deposited in the valleys of the major streams and their tributaries. These deposits are relatively recent, and the soils show little evidence of horizon development.

Relief

Adair County is a part of the Ozark Plateau, which covers a considerable part of Oklahoma, Missouri, and Arkansas. The county is in the drainage basin of the Arkansas River. The northern part is drained by the Illinois River and by Barren Fork, Evansville, and Caney Creeks. The southern part is drained by the south-flowing Sallisaw Creek and by Little Lee Creek. The amount of runoff in this part is generally greater than in the northern part, and the velocity is more rapid, especially on steep slopes.

In areas where slopes are steep, rock weathering, or the formation of soil by geologic erosion, is offset by erosion caused by rapid runoff. As a result, the soils are shallower. On the more gentle slopes, however, the soils have strongly developed horizons. The amount of runoff is also influenced by the amount and kind of vegetation and by the texture of the soil. Differences in slope gradient affect soil temperature, moisture, and aeration.

Time

The length of time needed for soil to form depends to a large extent on the other factors of soil formation. Soils develop more rapidly in humid, warm regions that have luxuriant vegetation than in dry or cold regions with scanty vegetation.

The age of the soils in Adair County varies widely. Soils on the smoother uplands and on the older stream terraces have been in place a long time and have more mature development. On the steeper slopes, soil development has been retarded by the effects of runoff and erosion. Consequently, the horizons are not so thick nor so strongly developed as those of the more mature soils. On first bottoms where local alluvium is deposited, the materials have not been in place long enough for mature soils to develop.

Classification and Morphology of Soils

Soils are placed in narrow classes for the organization and application of knowledge about their behavior within farms, ranches, or counties. They are placed in broad classes for study and comparison of large areas such as continents. In the comprehensive system of soil classification used in the United States, the soils are placed in six categories. Beginning with the highest, the six categories are order, suborder, great soil group, family, series, and type.

In the highest category, the soils of the whole country are grouped into three orders; in the lowest category, thousands of soil types are recognized in the United States. The suborder and family categories have never been fully developed and have been little used. Most attention has been given to the classification of soils into soil types and series within counties or comparable areas and to the subsequent grouping of series into great soil groups. Soil types are divided into phases, for which finer distinctions in use and management can be made. Soil series, types, and phase are defined in the Glossary at the back of this report.

Classes in the highest category of the classification scheme are the zonal, intrazonal, and azonal orders. The zonal order consists of soils with evident, genetically related horizons that reflect the dominant influence of climate and living organisms in their formation. In Adair County the great soil groups in the zonal order are Brunizem soils and Red-Yellow Podzolic soils.

In the intrazonal order are soils with evident, genetically related horizons that reflect the dominant influence of a local factor of topography or parent materials over the effects of climate and living organisms. In Adair County only Planosols are in the intrazonal order.

The azonal order consists of soils that lack distinct, genetically related horizons, commonly because they are young, have resistant parent materials, or are on steep slopes. In Adair County the great soil groups in the azonal order are Alluvial soils and Lithosols.

In table 13 the soil series are listed by great soil groups and important characteristics of each series are given. In the following pages each great soil group represented in Adair County is described. Also described is a profile representative of each series. Unless otherwise stated, the description is that of a dry soil.

TABLE 13.—*Soil series classified by higher categories and some of the factors that have contributed to their morphology*

Great soil group and soil series	Parent material	Relief	Drainage	Native vegetation
ZONAL				
Brunizem soils:				
Craig	Cherty limestone	Gently sloping to moderately sloping.	Moderately good to excessive.	Prairie grasses.
Jay	Loamy alluvium or loess	Nearly level to gently sloping.	Moderately good	Prairie grasses.
Summit	Limestone	Nearly level to moderately sloping.	Moderately good	Prairie grasses.
Red-Yellow Podzolic soils:				
Bodine	Cherty limestone	Gently sloping to very steep.	Good to excessive	Mixed hardwood and pine forest.
Dickson	Cherty limestone	Nearly level to gently sloping.	Moderately good to good.	Mixed hardwood and pine forest.
Etowah	Old alluvium	Nearly level to strongly sloping.	Good	Mixed hardwood and pine forest.
Greendale	Creep material and talus from cherty limestone.	Moderately sloping to strongly sloping.	Good	Mixed hardwood and pine forest.
Linker	Sandstone	Gently sloping to moderately sloping.	Good	Hardwood forest.
INTRAZONAL				
Planosols:				
Lawrence	Cherty limestone	Nearly level	Somewhat poor	Hardwood forest.
Parsons	Clayey alluvium	Nearly level to slight depressions.	Somewhat poor	Prairie grasses.
Taft	Silty and clayey alluvium.	Nearly level	Somewhat poor	Hardwood forest.
Taloka	Clayey and silty alluvium.	Nearly level	Somewhat poor	Prairie grasses.
AZONAL				
Alluvial soils:				
Huntington	Alluvium	Nearly level	Good	Hardwood forest.
Osage	Clayey alluvium	Nearly level	Poor	Water-tolerant hardwood forest.
Lithosols:				
Hector	Sandstone	Gently sloping to very steep.	Good to excessive	Hardwood forest.
Sogn	Limestone	Gently sloping to strongly sloping.	Good	Mixed hardwoods and prairie grasses.

Brunizem soils

In Adair County the soil series in the Brunizem great soil group are the Craig, Jay, and Summit.

Most of the Brunizem soils are fairly dark because of the long-continued accumulation and decay of tall and short prairie grasses. As a result they tend to have a high accumulation of organic matter. The Brunizem soils have undergone continued weathering for a long time, and they reflect the dominant effect of climate. They are mature and have a well-developed profile.

CRAIG SERIES.—The Craig soils are of minor extent, have gentle to moderate slopes, and occur in small areas in the Springfield Structural Plain physiographic area near Westville. These soils formed from cherty limestone. They are somewhat excessively drained. The Craig soils have a darker brown A horizon than the nearby Dickson soils.

Profile of Craig cherty silt loam, 1 to 5 percent slopes, in a tame pasture in the center of the west side of the NW¼ sec. 32, T. 19 N., R. 25 E.

A11—0 to 5 inches, dark grayish-brown (10YR 4/2) cherty silt loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; friable; rapidly permeable; many roots; many worm casts; chert 15 to 20 percent by volume; slightly acid, pH 6.2; gradual boundary.

A12—5 to 11 inches, brown (10YR 5/3) very cherty silt loam, dark brown (10YR 3/3) when moist; moderate, medium, granular structure; friable; rapidly permeable; many roots; chert 40 to 50 percent by volume; medium acid, pH 5.8; irregular boundary.

B2t—11 to 26 inches +, red (2.5YR 5/8) very cherty heavy silty clay loam, red (2.5YR 4/8) when moist; roots and water penetrate this horizon freely through the interstices; strongly acid, pH 5.2.

The thickness of the A horizon ranges from 6 to 15 inches. The texture is cherty silt loam. The color ranges from grayish brown to dark brown. The texture of the B horizon ranges from very cherty silty clay loam to very cherty silty clay. The color is reddish-brown to red. Depth to very cherty material ranges from 9 to 24 inches and averages 14 inches. Reaction of the soil ranges from strongly acid to medium acid.

JAY SERIES.—The Jay soils have nearly level or gentle slopes and occur in the broad valleys of the Springfield Structural Plain physiographic area near Stilwell and Westville. These soils are moderately well drained and have a weak fragipan. They developed in old loamy alluvium or loess. Low mounds occur in places. The Jay soils characteristically have a dark A1 horizon, a light-colored A2 horizon, and a mottled, moderately fine textured B horizon. They have less clay in the subsoil than the nearby Parsons and Taloka soils.

Profile of Jay silt loam, 0 to 2 percent slopes, in a cultivated field about 4 miles northeast of Westville, and 960 feet east and 200 feet south of the west quarter corner of sec. 16, T. 18 N., R. 26 E.

A1—0 to 12 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) when moist; weak, granular structure; friable; slightly hard when dry; medium acid, pH 5.6; gradual, smooth boundary.

A2—12 to 24 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; few, faint, yellowish-brown mottles; very friable when moist, slightly hard when dry; strongly acid, pH 5.5; diffuse, smooth boundary.

B2t—24 to 36 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 5/3) when moist; many, distinct, yellowish-brown, dark-gray, and yellowish-red mottles; moderate, medium, subangular blocky structure; firm when moist, hard when dry; very strongly acid, pH 4.5; clear, smooth boundary.

Bx—36 to 44 inches, mottled light-gray, dark-gray, and yellowish-brown light silty clay loam; weak, coarse, subangular blocky structure; brittle when moist, very hard when dry; few, round, black concretions; very strongly acid, pH 4.5; clear, smooth boundary.

C—44 to 66 inches +, mottled light-gray and yellowish-brown light, massive material; friable when moist, hard when dry; very strongly acid, pH 4.5.

The A horizon is silt loam and ranges from 14 to 30 inches in thickness. In most areas, however, the range is from 18 to 26 inches. When this layer is moist, the color is ordinarily very dark grayish brown, but it ranges to very dark brown. The B horizon is generally silty clay loam but ranges to clay loam. The color of the B horizon ranges from pale brown to brown and light yellowish brown mottled with grayish and reddish shades. The fragipan is weak to distinct and depth to it ranges from 30 to 50 inches.

SUMMIT SERIES.—The Summit soils have nearly level to moderate slopes and occur in the broad valleys of the Springfield Structural Plain physiographic area near Stilwell and Westville. They developed in material that weathered from limestone and shale. They are moderately well drained. These soils are near the Sogn soils, which they resemble in color and texture. They are, however, from 2 to 8 feet thick over limestone, whereas the Sogn soils are only 6 to 16 inches thick over limestone.

Profile of Summit silty clay loam, 1 to 3 percent slopes, in a cultivated field about 2¼ miles southeast of Westville and 1,500 feet east of the northwest corner of sec. 9, T. 17 N., R. 26 E.

A1—0 to 14 inches, very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) when moist; strong, medium and fine, granular structure; friable; permeable; neutral, pH 7.0; gradual, wavy boundary.

B1—14 to 24 inches, very dark grayish-brown (10YR 3/2) heavy silty clay loam, very dark brown (10YR 2/2) when moist; strong, medium, granular structure; firm when moist; slowly permeable; prominent, thin clay films; few, soft, rust-brown concretions; neutral, pH 6.8; clear, wavy boundary.

B2—24 to 48 inches, dark grayish-brown (2.5Y 4/2) light silty clay, very dark grayish brown (2.5Y 3/2) when moist; distinct, common, fine, light olive-brown mottles; strong, medium, subangular blocky structure; few, soft, rust-brown and black concretions; distinct clay films; slightly acid, pH 6.5; clear, wavy boundary.

C—48 to 56 inches, light olive-brown (2.5Y 5/6) and grayish-brown (2.5Y 5/2) massive silty clay, olive brown (2.5Y 4/4) and dark grayish brown (2.5Y 4/2) when moist; few, soft, rust-brown and black concretions; moderately alkaline, pH 8.0; clear, irregular boundary.

R—Bluish-gray limestone.

The A horizon ranges from 6 to 16 inches in thickness and averages about 14 inches. It is a black to grayish-brown silty clay loam or clay loam. The B horizon is about 34 inches thick. It is mottled light brownish-gray to very dark grayish-brown silty clay loam to silty clay. The texture of the B horizon is generally light silty clay or silty clay. Soil reaction in most places is slightly acid to neutral.

Red-Yellow Podzolic soils

Soils of the Red-Yellow Podzolic great soil group in Adair County belong to the Bodine, Dickson, Etowah, Greendale, and Linker series. These are zonal soils that have distinct, genetically related horizons that reflect the dominant influence of climate and living organisms on their formation. They developed under mixed hardwoods with which there are some pines and an understory of native grasses and legumes. The parent material, texture, drainage, color, structure, and slope of soils in these series vary widely.

BODINE SERIES.—The well-drained to excessively drained Bodine are the most extensive soils in Adair County and occur in wide areas of timbered or formerly timbered uplands of the Springfield Structural Plain physiographic area. Slopes are mainly very steep, but they range from 1 to 50 percent. These soils developed from cherty limestone. They contain more and larger chert fragments than the nearby Dickson soils and in most places are on steeper slopes.

Profile of Bodine very cherty silt loam, 1 to 8 percent slopes, in a cultivated field 4½ miles north of Stilwell and 100 feet east of U.S. Highway No. 59, in the center of sec. 15, T. 16 N., R. 25 E.

A1—0 to 3 inches, light brownish-gray (10YR 6/2) very cherty silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, granular structure; friable; rapidly permeable; many roots; chert fragments, ½ inch to 8 inches across and 30 to 75 percent by volume; slightly acid, pH 6.1; gradual, wavy boundary.

A2—3 to 14 inches, very pale brown (10YR 8/3) very cherty silt loam, pale brown (10YR 6/3) when moist; weak, fine and medium, granular structure; friable; permeable; many roots in upper part; chert fragments 40 to 80 percent by volume; medium acid, pH 6.0; gradual, wavy boundary.

B1—14 to 20 inches, very pale brown (10YR 7/3) very cherty light silty clay loam, yellowish brown (10YR 5/4) when moist; weak, fine, subangular blocky structure; friable; rapidly permeable; chert fragments 60 to 90 percent by volume; strongly acid, pH 5.1; gradual, irregular boundary.

B2t—20 to 36 inches +, chert bed; reddish-yellow (5YR 6/6) silty clay loam coating on chert fragments and in interstices, yellowish red (5YR 5/6) when moist; coarsely mottled in places with very pale brown and strong brown; weak, fine, subangular blocky structure; slightly hard when dry, friable when moist; roots can penetrate through crevices and interstices; volume of angular chert and rock increases with increasing depth and makes up 95 percent or more of the total volume; very strongly acid, pH 4.5.

The size and volume of the chert fragments vary widely, but the volume always increases with increasing depth. The chert ranges from fragments one-half inch across to boulders and rock outcrops. The volume of chert ranges from 30 to 80 percent in the A horizon and from 50 to 95 percent in the subsoil. The color of the A horizon ranges from light brownish gray to dark brown and that of the subsoil ranges from yellowish brown to strong brown. The texture of the surface layer is very cherty or stony silt loam. This layer is about 6 to 12 inches thick and has weak, fine to medium, granular structure. The more cherty subsoil layer is about 12 inches thick and is very cherty silty clay loam. It has weak, subangular blocky structure that is not readily determined because of the very high chert content. Thickness of the solum above the chert bed commonly ranges from 1 to 4 feet. Reaction of the soil ranges from strongly acid to medium acid.

Dickson Series.—The well-drained Dickson soils are extensive in the county and occur on timbered or formerly timbered, nearly level or gently sloping ridges and mountaintops of the Springfield Structural Plain physiographic area in the central and northern parts of the county. These soils developed from cherty limestone. They have less chert in all horizons than Bodine soils. They have less clay in the subsoil and more chert throughout than Lawrence soils.

Profile of Dickson cherty silt loam, 0 to 3 percent slopes, in a tame pasture about 2 miles northwest of Westville, and 1,250 feet west and 75 feet north of the southeast corner of sec. 26, T. 18 N., R. 25 E.

A1—0 to 3 inches, light brownish-gray (10YR 6/2) cherty silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; very friable; chert about 15 percent by volume; medium acid, pH 5.6; clear boundary.

A2—3 to 10 inches, very pale brown (10YR 7/3) cherty silt loam, brown (10YR 5/3) when moist; weak, fine, granular structure; very friable; chert about 20 percent by volume; strongly acid, pH 5.3; gradual boundary.

B1—10 to 14 inches, light-brown (7.5YR 6/4) cherty heavy silt loam, brown (7.5YR 4/4) when moist; weak, fine, subangular blocky structure; friable; chert about 20 percent by volume; strongly acid, pH 5.3; diffuse boundary.

B2t—14 to 26 inches light-brown (7.5YR 6/4) cherty light silty clay loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; friable; chert about 30 percent by volume; strongly acid, pH 5.3; gradual boundary.

Bx—26 to 34 inches, mottled pale-brown, light yellowish-brown, and reddish-yellow cherty light silty clay loam; moderate, medium, blocky structure; brittle when moist, hard when dry; chert about 30 percent by volume; strongly acid, pH 5.3; gradual boundary.

C—34 to 44 inches, mottled pale-brown, light yellowish-brown, and reddish-yellow cherty silt loam; chert about 50 percent by volume; gradual, wavy boundary.

R—44 to 60 inches +, chert bed.

Cherty silt loam is the dominant soil type of the Dickson soils. It has 10 to 25 percent chert in the A horizon, whereas Dickson silt loam contains less than 10 percent chert or may have no chert in the surface layer.

The surface layer of Dickson cherty silt loam, 0 to 3 percent slopes, is a pale-brown to light brownish-gray cherty silt loam about 10 inches thick. It generally has weak, fine, granular structure. The chert fragments increase in size and in volume with increasing depth. Fragments in the A horizon are as much as 6 inches across and average 2 to 4 inches.

The texture of the B horizon ranges from cherty heavy silt loam to cherty silty clay loam. The color of this horizon ranges from very pale brown to light yellowish brown, brownish yellow, or yellowish brown. Mottling occurs in places in the lower part. This horizon is about 24 inches thick. Its structure ranges from moderate, medium, granular to subangular blocky. A weak to distinct fragipan occurs in places at a depth of 20 to 30 inches. The fragipan varies widely in thickness; it may be only a few inches or as much as a foot thick.

The thickness of the profile above the chert bed commonly ranges from 27 to 50 inches. Reaction is strongly acid to medium acid.

Etowah Series.—The Etowah soils developed in alluvium washed mainly from soils on cherty limestone. These well-drained, nearly level to strongly sloping soils are extensive and occur along most of the streams and the rivers and in broad valleys throughout the county.

The Etowah soils are on higher bottoms than the nearby Huntington soils, which are occasionally flooded, and have a more developed subsoil. The Etowah soils are adjacent to the Greendale soils, which are on the higher foot slopes and contain angular chert fragments with sharp edges. Chert in the Etowah soils is generally waterworn and rounded.

Profile of Etowah gravelly silt loam, 1 to 3 percent slopes, in a cultivated field on the Eastern Oklahoma Field Station at Baron about 600 feet northwest of U.S. Highway No. 59 in the NW¼ sec. 26, T. 17 N., R. 25 E.

Ap—0 to 10 inches, pale-brown (10YR 6/3) gravelly silt loam, dark brown (10YR 4/3) when moist; weak, medium, granular structure; friable; permeable; many, small, rounded pebbles (35 percent by weight); medium acid, pH 6.0; gradual boundary.

B1—10 to 17 inches, light-brown (7.5YR 6/4) gravelly heavy silt loam, dark brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; many, small, rounded pebbles (41 percent by weight); strongly acid, pH 5.5; gradual boundary.

B2t—17 to 26 inches, reddish-yellow (5YR 6/6) gravelly light silty clay loam, yellowish red (5YR 4/6) when moist; moderate, medium, granular and subangular blocky structure; many rounded pebbles, about 50 percent by weight, which increase in size and in volume with increasing depth; strongly acid, pH 5.5; gradual boundary.

C—26 to 5 0inches +, bed of gravel and yellowish-red (5YR 5/6) very gravelly light silty clay loam, yellowish red (5YR 4/6) when moist; about 90 percent rounded chert by weight, which increases in size and volume with increasing depth; chert ranges from ¼ inch to 4 inches across; very firmly impacted; strongly acid, pH 5.5.

The A horizon in most places is about 8 to 15 inches thick. The texture is a gravelly silt loam, and the structure is weak to moderate, medium or fine, granular. The color ranges from pale brown to yellowish brown. The subsoil is generally about 16 inches thick but it may range in some places to about 45 inches. In texture, the B horizon is a gravelly heavy silt loam to gravelly silty clay loam. It has moderate, medium, granular to subangular blocky structure. The color is reddish yellow to reddish brown.

The content of gravel in the A horizon ranges from 10 to 30 percent by volume and averages about 15 percent. In the subsoil it is highly variable. The upper part may contain about 50 percent, and the lower part may contain as much as 80 or 90 percent. In some places the Etowah soils have a silt loam surface layer and are almost free of gravel. There is generally less than 10 percent gravel in and on the A horizon. The Etowah soils range from strongly acid to slightly acid.

GREENDALE SERIES.—The well-drained Greendale soils developed from talus and from creep material from cherty limestone. They are not extensive in Adair County, and they are mapped only with the Etowah soils as an undifferentiated unit. The unit, which is Etowah and Greendale soils, 3 to 8 percent slopes, consists of about 65 percent Etowah gravelly silt loam and 35 percent Greendale cherty silt loam. The Etowah component is described elsewhere in this report. The Greendale soils are on moderately sloping to strongly sloping foot slopes and on colluvial and alluvial fans. In most places they are along the streams and rivers throughout the county. The Etowah soils generally occupy the lower part of the foot slope, and the Greendale soils occupy the upper part. Waterworn chert gravel occurs in the Etowah soils, and chert fragments with sharp edges occur in the Greendale soils. The Greendale soils are well drained and moderately permeable.

Profile of Greendale cherty silt loam, 2 miles south of the Rock Springs School in the southwest corner of the SW¼ sec. 19, T. 15 N., R. 26 E.

A1—0 to 5 inches, pale-brown (10YR 6/3) cherty silt loam, brown (10YR 4/3) when moist; very weak, fine, granular structure; friable; chert 20 percent by volume; strongly acid, pH 5.5; gradual, wavy boundary.

A3—5 to 16 inches, pale-brown (10YR 6/3) cherty silt loam, brown (10YR 5/3) when moist; very weak, fine, granular structure; friable; chert about 25 percent by volume; gradual, smooth boundary.

B1—16 to 22 inches, very pale brown (10YR 7/4) cherty silt loam, light yellowish brown (10YR 6/4) when moist; weak, fine, granular structure; friable; chert 30 to 40 percent by volume; very strongly acid, pH 5.0; diffuse boundary.

B2—22 to 60 inches +, cherty heavy silt loam, brown (10YR 5/3) when moist; weak, subangular blocky structure; friable; chert 40 to 50 percent by volume; very strongly acid, pH 5.0.

The A horizon is very pale brown to light brownish-gray cherty silt loam. It has very weak, fine to medium, granular structure. This layer ranges from 10 to 18 inches in thickness. The amount of chert ranges from 10 to 30 percent. The B horizon is light yellowish-brown to brown silt loam to light silty clay loam. The chert content ranges from 30 to 50 percent and increases with increasing depth. Thickness of this horizon ranges from about 25 to 50 inches. The soil is medium acid to very strongly acid.

LINKER SERIES.—The Linker soils developed from reddish sandstone and some sandy shale. These well-drained soils are moderately extensive. They have gentle to moderate slopes and occur on the timbered or formerly timbered Boston Mountains physiographic area, mainly in the southern part of the county. The Linker soils occur with Hector soils, but they are deeper and generally free of sandstone gravel or rocks that are commonly in most of the Hector soils.

Profile of Linker fine sandy loam, 1 to 5 percent slopes, in a cultivated field about 4 miles southeast of Stilwell and 1,000 feet west of the northeast corner of sec. 17, T. 15 N., R. 26 E.

Ap—0 to 6 inches, light-brown (7.5YR 6/4) fine sandy loam, dark brown (7.5YR 4/4) when moist; weak, fine, granular structure; friable; permeable; slightly acid, pH 6.5; gradual, wavy boundary.

B1—6 to 11 inches, reddish-brown (5YR 5/4) loam, dark reddish brown (5YR 3/4) when moist; weak, medium, granular structure; friable; medium acid, pH 6.0; clear, wavy boundary.

B21t—11 to 23 inches, red (2.5YR 5/6) heavy loam, red (2.5YR 4/6) when moist; weak, medium, subangular blocky structure; friable; permeable; medium acid, pH 6.0; gradual, irregular boundary.

B22t—23 to 30 inches, red (2.5YR 5/6) light clay loam, red (2.5YR 4/6) when moist; weak, medium, subangular blocky structure; many small fragments of sandstone; strongly acid, pH 5.5; gradual, wavy boundary.

C—30 to 34 inches +, red (2.5YR 5/8) soft, disintegrated sandstone and sandy clay, red (2.5YR 4/8) when moist; strongly acid, pH 5.5.

Fine sandy loam is the dominant soil type in the Linker series. Linker loam differs from Linker fine sandy loam in having a loam A horizon and clay loam B horizon.

The A horizon of Linker fine sandy loam is about 6 to 10 inches thick in most places. It has weak, granular to weak, fine, granular structure. The color ranges from grayish brown to dark brown. The B horizon is sandy clay loam to clay loam about 20 to 26 inches thick. It has weak, medium, granular to subangular blocky structure. The color is yellowish brown to red.

In places sandstone gravel occurs in all horizons. When this soil is cultivated, the A1 and A2 horizons are generally mixed. In woodlands they appear as distinct, separate horizons. Reaction ranges from strongly acid to slightly acid.

Planosols

These intrazonal soils have more or less well developed characteristics that reflect the dominating influence of some local factor of relief or parent material over the normal influences of climate and vegetation.

In Adair County, the soil series in the Planosol group are the Lawrence, Parsons, Taft, and Taloka. These soils are in nearly level areas or in depressions that have little or no runoff. They contain excess water all or part of the

time. They have a grayish A horizon and a compact, clayey subsoil. Some of the soils developed under forests, and others developed under native prairie grasses. All typically are somewhat poorly drained, and commonly they have low mounds. The parent materials, as well as other characteristics of these soils, vary widely.

LAWRENCE SERIES.—The imperfectly drained Lawrence soils are in small nearly level areas or slight depressions of the timbered or formerly timbered Springfield Structural Plain physiographic area. They developed from cherty limestone. In most places they are surrounded by the Dickson soils, which generally have more chert in the A horizon and less clay than the Lawrence soils.

Profile of Lawrence silt loam, once cleared and now in brush, 3½ miles southwest of Watts in the northeast corner of the NW¼ sec. 35, T. 19 N., R. 25 E.

A1—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; friable; permeable; many roots; many worm casts; slightly acid, pH 6.2; gradual boundary.

A2—3 to 8 inches, very pale brown (10YR 7/4) silt loam, yellowish brown (10YR 5/4) when moist; weak, fine, granular structure; friable; permeable; few roots; few worm casts; medium acid; pH 5.7; gradual boundary.

B1—8 to 15 inches, very pale brown (10YR 7/4) light silty clay loam, yellowish brown (10YR 5/4) when moist; moderate, medium, granular structure; friable when moist, hard when dry; strongly acid, pH 5.3; gradual boundary.

B21t—15 to 20 inches, very pale brown (10YR 7/4) silty clay loam, light yellowish brown (10YR 6/4) when moist; common, distinct, medium, very pale brown and strong-brown mottles; moderate, medium, subangular blocky structure; plastic when wet, hard when dry; few roots; few, small, rounded concretions of iron and manganese; few small chert fragments; amount of chert increases with increasing depth; very strongly acid, pH 5.3; gradual boundary.

B22t—20 to 36 inches +, silty clay with many, prominent, strong-brown, yellowish-red, very pale brown, and white mottles; strong, fine, subangular blocky structure; plastic when wet, hard when dry; few small chert fragments; amount of chert increases with increasing depth; few, small, round concretions of iron and manganese; strongly acid, pH 5.3.

The A horizon is silt loam and ranges from 8 to 10 inches in thickness and from pale brown to dark gray in color. The B horizon ranges from silty clay loam to silty clay in texture, from 24 to 40 inches in thickness, and from mottled pale brown to mottled light gray in color. Reaction ranges from strongly acid to medium acid.

PARSONS SERIES.—The Parsons soils formed in clayey alluvium over cherty limestone. These imperfectly drained soils are not extensive and occur mainly near Westville and Stilwell. They are in small, nearly level areas or in slight depressions on prairies of the Springfield Structural Plain physiographic area. Low mounds are common.

The Parsons soils are associated with the Jay and Taloka soils. Their A horizon is not so thick as that of the Jay soils and their B horizon has more clay.

Profile of Parsons silt loam, 0 to 1 percent slopes, in a cultivated field about one-quarter mile northeast of Westville and 1,000 feet south of the northwest corner of sec. 32, T. 18 N., R. 26 E.

A1p—0 to 6 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, granular structure; friable; permeable; medium acid, pH 5.8; gradual, wavy boundary.

A1—6 to 10 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown when moist; weak, fine, granular structure; friable; permeable; strongly acid, pH 5.5; gradual, wavy boundary.

A2—10 to 14 inches, gray (10YR 6/1) silt loam, grayish brown (10YR 5/2) when moist; weak, fine, granular structure; few, faint, fine, yellowish-brown mottles; many, small, black concretions; strongly acid, pH 5.5; abrupt, wavy boundary.

B2t—14 to 46 inches, light yellowish-brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) when moist; many, distinct, medium, strong-brown, yellowish-brown, and gray mottles; weak, medium, blocky structure; clay films prominent; many, small, black concretions; a few angular chert fragments in lower part; number of mottles and amount of chert increase with increasing depth; strongly acid, pH 5.5; gradual, wavy boundary.

C—46 inches +, chert gravel imbedded in yellow (10YR 7/6) and light brownish-gray (10YR 6/2) massive clay, brownish yellow and grayish brown when moist; many, coarse, distinct, dark-brown mottles; many, small, black concretions; strongly acid, pH 5.5.

The A horizon ranges from 8 to 15 inches in thickness and from light brownish gray to dark grayish brown in color. The texture of the B horizon ranges from silty clay to clay. The color ranges from light yellowish brown to dark grayish brown with many mottles. In most places the B horizon is about 32 inches thick. Reaction ranges from strongly acid to medium acid.

TAFT SERIES.—The Taft soils formed in sediments that washed from soils on cherty limestone and from minor areas of soils on limestone and shale. They are relatively inextensive in the county and occur on second bottoms mostly along Barren Fork and the Illinois River. They are nearly level and low mounds are common. These soils are imperfectly drained. The Taft soils are near the Osage soils, which are generally on lower bottoms, are darker, and have more clay in all soil layers.

Profile of Taft silt loam in a cultivated field along Barren Fork 200 feet northeast of the SW¼ sec. 17, T. 17 N., R. 25 E.

A1p—0 to 10 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; friable; permeable; many worm casts; slightly acid, pH 6.5; gradual boundary.

A2—10 to 22 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; few, fine, faint, yellow mottles; weak, fine, granular structure; slightly hard when dry, plastic when moist; medium acid, pH 6.0; gradual boundary.

B2t—22 to 39 inches, very pale brown (10YR 7/3) heavy silty clay loam, pale brown (10YR 6/3) when moist; common, distinct, fine and medium, brownish-yellow and yellowish-brown mottles; moderate, medium, blocky structure; very hard when dry, firm when moist; medium acid, pH 6.0; gradual boundary.

C—39 to 56 inches +, light-gray (10YR 7/2) heavy silty clay loam, light brownish gray (10YR 6/2) when moist; weakly stratified with less clayey material; common, distinct, medium, brownish-yellow and yellowish-brown mottles; massive (structureless); very hard when dry, firm when moist; medium acid, pH 6.0.

The A1 horizon is silt loam and is about 10 inches thick. It has weak, fine, granular structure. The color ranges from dark grayish brown to gray. The A2 horizon, which is about 12 inches thick, is light-gray silt loam. It has weak, fine, granular structure. In most

places this horizon is faintly mottled with yellow. The B horizon is a light clay loam to light clay and is about 17 to 20 inches thick. It has moderate, medium, blocky structure. It is light gray to pale brown in color and is distinctly mottled with shades of yellowish brown. Depth to the very gravelly chert bed is from 3 to 6 feet. Reaction is strongly acid to slightly acid.

TALOKA SERIES.—The Taloka soils formed in old clayey and silty alluvium. They are not extensive and occur on the nearly level upland prairies of the Springfield Structural Plain near Stilwell and Westville. Low mounds are common. The Taloka soils are imperfectly or somewhat poorly drained. They occur near the Parsons and Jay soils. They have a less clayey B horizon and a thinner A horizon than the Parsons soils.

Profile of Taloka silt loam, 0 to 1 percent slopes, in a cultivated field 1 mile east and 4 miles north of Westville in the southeast corner of the SW¼ sec. 9, T. 18 N., R. 26 E.

Ap—0 to 8 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; common, faint, light yellowish-brown mottles; weak, medium, granular structure; friable; permeable; many roots; many worm casts; medium acid, pH 5.6; gradual boundary.

A2—8 to 20 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; common, faint, light yellowish-brown and yellowish-brown mottles; weak, medium, granular structure; friable; permeable; many roots; many worm casts; strongly acid, pH 5.1; clear boundary.

B21t—20 to 32 inches, gray (10YR 5/1) light silty clay, dark grayish brown (10YR 4/2) when moist; many, distinct, medium, red, strong-brown, and grayish-brown mottles; ped faces distinctly coated with white silt; moderate, medium, subangular blocky structure; plastic when wet, hard when dry; very slowly permeable; few roots; few iron concretions; strongly acid, pH 5.1; gradual boundary.

B22t—32 to 42 inches, grayish-brown (10YR 5/2) massive light silty clay, dark grayish brown (10YR 4/2) when moist; many, distinct, medium, red, strong-brown, and grayish-brown mottles; plastic when wet, hard when dry; very slowly permeable; many strong-brown iron concretions; few, small, chert fragments; strongly acid, pH 5.1; gradual boundary.

B3—42 to 70 inches, light-gray (10YR 7/2) light silty clay, grayish brown (10YR 5/2) when moist; common, distinct, fine, brownish-yellow and strong-brown mottles; moderate, medium, subangular blocky structure; plastic when wet, hard when dry; very slowly permeable; many iron concretions; few, small, chert fragments; chert increases with increasing depth; strongly acid, pH 5.5.

The A horizon is slightly mottled light-gray to very pale brown silt loam about 20 inches thick. The B horizon is mottled light-gray to grayish-brown light silty clay or compact silty clay 40 to 50 inches thick. The reaction ranges from strongly acid to medium acid.

Alluvial soils

In Adair County the soil series in the Alluvial great soil group are the Huntington and Osage. These soils have little profile development. They are on first bottoms in local alluvium that was deposited recently. The soil material has not been in place long enough for the soils to develop and form distinct genetic layers. Both the Huntington and Osage soils formed under forests from sediments carried by streams and deposited on the bottom lands and flood plains. Because of variations in their parent materials, they may vary from place to place in texture, color, and arrangement of soil layers.

HUNTINGTON SERIES.—The Huntington soils developed in sediments that washed from soils on cherty limestone, limestone, sandstone, and shale. These well-drained soils occur along nearly all the perennial and intermittent streams throughout the county. They are on nearly level first bottoms and are subject to occasional flooding, especially during seasons of unusually high rainfall.

The Etowah soils are on higher bottoms than the Huntington soils. They are seldom flooded and have a better developed B horizon than the Huntington soils. Gravelly alluvial land is near the Huntington soils. It is more gravelly throughout and is subject to more frequent flooding than the Huntington soils.

Profile of Huntington gravelly loam in a formerly cultivated field about 5½ miles northwest of Stilwell and 800 feet east and 300 feet south of the northwest corner of sec. 30, T. 16 N., R. 25 E.

A11—0 to 8 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; friable when moist; gravel about 15 percent by volume; slightly acid, pH 6.3; gradual boundary.

AC—8 to 25 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; gravel about 30 percent by volume; neutral, pH 6.7; gradual boundary.

C—25 to 60 inches +, brown (10YR 5/3) very gravelly loam, brown (10YR 4/3) when moist; porous; massive (structureless); gravel about 60 percent by volume.

The A horizon ranges from 6 to 40 inches in thickness, but in most places it is 9 inches. This horizon may be free of gravel or may contain as much as 50 percent. In most places the average is between 15 and 20 percent (fig. 28).

***Figure 28.*—Profile of Huntington gravelly loam on a first bottom of Barren Fork.**

The texture of the A horizon generally is gravelly loam or silt loam, but in some small areas in the southern part of the county it is fine sandy loam. An AC horizon about 15 to 25 inches thick occurs in some places. It ranges from gravelly loam to gravelly silt loam in texture. The volume of gravel in this layer varies widely; it ranges from 20 to 60 percent but is greater in the lower part. The underlying material consists of beds of gravel, silt, and sand. The proportion of those materials varies but the volume of gravel in most places ranges from 60 to 80 percent. The color of the A horizon ranges from very dark grayish brown to dark reddish brown. The color of the C horizon ranges from brown to pink. In some places Huntington soils have a silt loam surface layer and have little gravel. In these places there is less than 10 percent gravel in and on the A horizon. Reaction of Huntington soils ranges from strongly acid to slightly acid.

OSAGE SERIES.—The Osage soils formed in clayey sediments that washed from soils on limestone and shale. These poorly drained soils are not extensive in the county and occur mainly along the Illinois River. They are on nearly level first bottoms and are flooded occasionally. They are associated with the Taft soils, which are grayer and have less clay in all horizons.

Profile of Osage clay loam in a cultivated field three-eighths mile north of Watts on the east side of road across from the Watts High School football field in the SE¼ sec. 18, T. 19 N., R. 26 E.

A1—0 to 12 inches, dark-gray (10YR 4/1) light clay loam, black (10YR 2/1) when moist; moderate, medium, granular structure; plastic when wet, hard when dry; moderately permeable; many roots; many wormholes; few, small, round pebbles; medium acid, pH 6.0; gradual boundary.

AC—12 to 21 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) when moist; common, distinct, medium, strong-brown mottles; moderate, medium, granular structure; plastic when wet, hard when dry; slowly permeable; few iron concretions; few roots; pebbles 10 to 15 percent by volume and 1/16 to 1 inch in diameter; slightly acid, pH 6.2; gradual boundary.

C—21 to 36 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) when moist; common, distinct, medium, strong-brown and black mottles; massive (structureless); plastic when wet, hard when dry; very slowly permeable; few roots; pebbles 10 to 15 percent by volume and 1/16 to 1 inch in diameter; slightly acid, pH 6.1.

The A horizon ranges from 8 to 15 inches in thickness and from light clay loam to light clay in texture. The AC horizon, if present, is clay loam and is about 8 to 10 inches thick. The underlying C horizon is massive grayish-brown or dark-gray clay. The color of the A and AC horizons is generally dark gray to black. In the C horizon it is dark gray to grayish brown, with brown, strong-brown, or black mottles. Reaction ranges from slightly acid to medium acid.

Lithosols

In Adair County the soil series in the Lithosol great soil group are the Hector and Sogn. These azonal soils have very little profile development. In many places they consist of very shallow or shallow soil material intermixed with partly weathered rock fragments on nearly barren rock outcrops. Most of these soils have steep slopes. On gentle slopes, the rock is resistant to weathering. The soil material has not been in place long enough for distinct, genetically related horizons to form.

The Hector soils are the most extensive in this great soil group. They formed under forests from sandstone and some shale. Sogn soils formed under prairie grasses from dense, fossiliferous limestone.

HECTOR SERIES.—The Hector soils developed from sandstone and some shale. These somewhat excessively drained soils are among the most extensive in the county. They occur in wide areas of the timbered and formerly timbered Boston Mountains physiographic area, mainly in the southern part of the county. They have gentle to very steep slopes and range from shallow to very shallow. The Hector soils are near the Linker soils, which differ in being deeper and in having a well-developed B horizon.

Profile of Hector fine sandy loam, 1 to 5 percent slopes, in a tame pasture about 5 miles southeast of Stilwell, on north side of road, 500 feet from the southeast corner of sec. 8, T. 15 N., R. 26 E.

Ap—0 to 10 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, fine to medium, granular structure; friable; permeable; many roots; slightly acid, pH 6.2; sandstone gravel on the surface and in this horizon; clear, irregular boundary.

C—10 to 12 inches, reddish-yellow (7.5YR 7/6) fine sandy loam and partly weathered sandstone, strong brown (7.5YR 5/6) when moist; solid sandstone in places; very few roots; strongly acid, pH 5.1.

R—12 inches +, sandstone bedrock.

The A horizon ranges from 5 to 20 inches in thickness, but in places it is absent. In some places there is a very thin sandy clay loam B horizon. In cultivated fields the A2 horizon is part of the Ap horizon, or plow layer. The texture of the A horizon ranges from fine sandy loam to stony fine sandy loam. In some areas there are no stones in the surface layer; in others there may be rocks as large as boulders and sandstone outcrops. The color of the A horizon ranges from grayish brown to reddish brown. Reaction ranges from strongly acid to medium acid.

SOGN SERIES.—The Sogn soils are not extensive in the county. They have gentle to strong slopes and generally are in narrow bands downslope from the steeper, stony Hector soils. The Sogn soils developed from limestone. Runoff is moderate to rapid and internal drainage is slow. The moisture-storage capacity of these soils is limited by the small volume of soil material.

The Sogn soils are near the Summit and Hector soils. The Hector soils have a lighter colored surface layer than Sogn soils and are sandy. Sogn soils are dark and clayey, and resemble the Summit soils in texture and color. The Summit soils, however, are much deeper and have a developed subsoil that Sogn soils do not have. The Sogn soils developed under mixed deciduous trees, brush, and some native grasses.

Profile of Sogn soils in brushy field about 250 feet north of the Old Baptist Mission on the west side of U.S. Highway No. 59, 1 mile west and 2¾ miles north of Westville in the SE¼ of sec. 13, T. 18 N., R. 25 E.

A1—0 to 7 inches, very dark grayish-brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) when moist; moderate, medium and fine, granular structure; friable; permeable; many roots; slightly acid, pH 6.2; abrupt, irregular boundary.

R—7 inches +, weathered, dense, bluish-gray, fossiliferous limestone that is level bedded and has vertical weathering joints; crevices in the bedrock contain some topsoil and are penetrated by roots.

The A horizon is very dark grayish-brown to nearly black clay loam. The thickness of this horizon averages about 7 or 8 inches. Although generally clay loam, the texture ranges from silty clay loam to heavy clay loam. The underlying material is weathered, dense, bluish-gray limestone. Limestone bedrock and flagstones occur at irregular intervals. Pockets of soil 6 to 16 inches thick are among the rocks. Sogn soils range from slightly acid to neutral.

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Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Consistence, soil. The feel of the soil and the ease with which it can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent; soil will not hold together in a mass.

Friable.—When moist, soil crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, soil crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, soil is readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, soil adheres to other material, and tends to stretch somewhat and pull apart, rather than pull free from other material.

Hard.—When dry, soil is moderately resistant to pressure; it can be broken with difficulty between thumb and forefinger.

Soft.—When dry, soil breaks into powder or individual grains under very slight pressure.

Cemented.—Soil is hard and brittle; little affected by moistening.

Diversion terrace. A ridge of earth built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Internal soil drainage. The downward movement of water through the soil profile. The rate of movement is determined by the texture, structure, and other characteristics of the soil profile and underlying layers, and by the height of the water table, either permanent or perched. Relative terms for expressing internal drainage are *none, very slow, slow, medium, rapid,* and *very rapid.*

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Parent material. The horizon of weathered rock or partly weathered soil material from which soil has formed; horizon C of the soil profile.

Permeability. The quality of a soil horizon that enables water and air to move through it. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil type, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects management.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that gives an alkaline reaction. In words, the degrees of acidity and alkalinity are expressed thus:

	pH		pH
Extremely acid	Below 4.5	Neutral	6.6–7.3
Very strongly acid	4.5–5.0	Mildly alkaline	7.4–7.8
Strongly acid	5.1–5.5	Moderately alkaline	7.9–8.4
Medium acid	5.6–6.0	Strongly alkaline	8.5–9.0
Slightly acid	6.1–6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Runoff. Surface drainage of rainwater or water from melted snow.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Site index. A numerical means of expressing the quality of a forest site that is based on the height of the dominant stand at an arbitrarily chosen age; for example, the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years.

Soil. A natural three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting upon parent material, as conditioned by relief, over periods of time.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), blocky (angular or subangular), and *granular*. *Structureless* soils are (1) *single grain* (each by itself, as in sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subgrade, engineering. The substratum, consisting of in-place material or fill material, that is prepared for highway construction; does not include stabilized base course or actual paving material.

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, usually about 5 to 8 inches in thickness. The plow layer.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Type, soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND RANGE SITES

[See table 5, p. 11, for approximate acreage and proportionate extent of soils, and table 6, p. 31, for estimated average acre yields of principal crops and fruits and gains in beef per acre. Table 8, p. 33, provides information on the suitability of some soils for shortleaf pine, and tables 10, 11, and 12, beginning on p. 44, contain information significant to engineering. Absence of data indicates soil is not suited to range or is not commonly used for it]

Map symbol	Soil name	Page	Capability unit: Symbol	Capability unit: Page	Range site: Name	Range site: Page
BdD	Bodine very cherty silt loam, 1 to 8 percent slopes	13	IVs-1	29	Smooth Chert Savannah	39
BoE	Bodine stony silt loam, 5 to 15 percent slopes	12	VIs-1	29	Smooth Chert Savannah	39
BsF	Bodine stony silt loam, steep	12	VIIs-1	30	Steep Chert Savannah	39
CrC	Craig cherty silt loam, 1 to 5 percent slopes	13	IVe-3	28	Loamy Prairie	38
DcB	Dickson silt loam, 1 to 3 percent slopes	14	IIe-2	26	Smooth Chert Savannah	39
DkA	Dickson cherty silt loam, 0 to 3 percent slopes	13	IIIs-1	28	Smooth Chert Savannah	39
EaA	Etowah silt loam, 0 to 1 percent slopes	15	I-2	26	Smooth Chert Savannah	39
EaB	Etowah silt loam, 1 to 3 percent slopes	15	IIe-2	26	Smooth Chert Savannah	39
EoB	Etowah gravelly silt loam, 1 to 3 percent slopes	14	IIe-2	26	Smooth Chert Savannah	39
EtD	Etowah and Greendale soils, 3 to 8 percent slopes	15	IVe-2	28	Smooth Chert Savannah	39
Ga	Gravelly alluvial land	15	Vw-1	29	--------------------	
Hc	Hector complex	16	VIIs-1	30	Shallow Savannah	38
HlC	Hector-Linker fine sandy loams, 1 to 5 percent slopes	17	IVe-1	28	Shallow Savannah	38
Hn	Huntington silt loam	17	I-1	25	--------------------	
Hu	Huntington gravelly loam	17	IIw-1	27	--------------------	
JaA	Jay silt loam, 0 to 2 percent slopes	18	IIe-2	26	Loamy Prairie	38
La	Lawrence silt loam	18	IIs-1	26	--------------------	
LkC	Linker fine sandy loam, 1 to 5 percent slopes	19	IIIe-2	27	Sandy Savannah	38
LkC2	Linker fine sandy loam, 3 to 5 percent slopes, eroded	19	IIIe-4	28	Sandy Savannah	38
LnC	Linker loam, 3 to 5 percent slopes	19	IIIe-2	27	Sandy Savannah	38
LnC2	Linker loam, 3 to 5 percent slopes, eroded	19	IIIe-4	28	Sandy Savannah	38
Oc	Osage clay loam	19	IIIw-2	28	Heavy Bottomland	39
PaA	Parsons silt loam, 0 to 1 percent slopes	20	IIs-1	26	Claypan Prairie	37
So	Sogn soils	20	VIIs-2	26	Very Shallow	38
SuA	Summit silty clay loam, 0 to 1 percent slopes	21	I-3	26	Loamy Prairie	38
SuB	Summit silty clay loam, 1 to 3 percent slopes	21	IIe-1	26	Loamy Prairie	38
SuC	Summit silty clay loam, 3 to 5 percent slopes	21	IIIe-1	27	Loamy Prairie	38
SuC2	Summit silty clay loam, 3 to 5 percent slopes, eroded	21	IIIe-3	27	Loamy Prairie	38
Ta	Taft silt loam	21	IIIw-1	28	----------------	
TkA	Taloka silt loam, 0 to 1 percent slopes	22	IIs-1	26	Loamy Prairie	38

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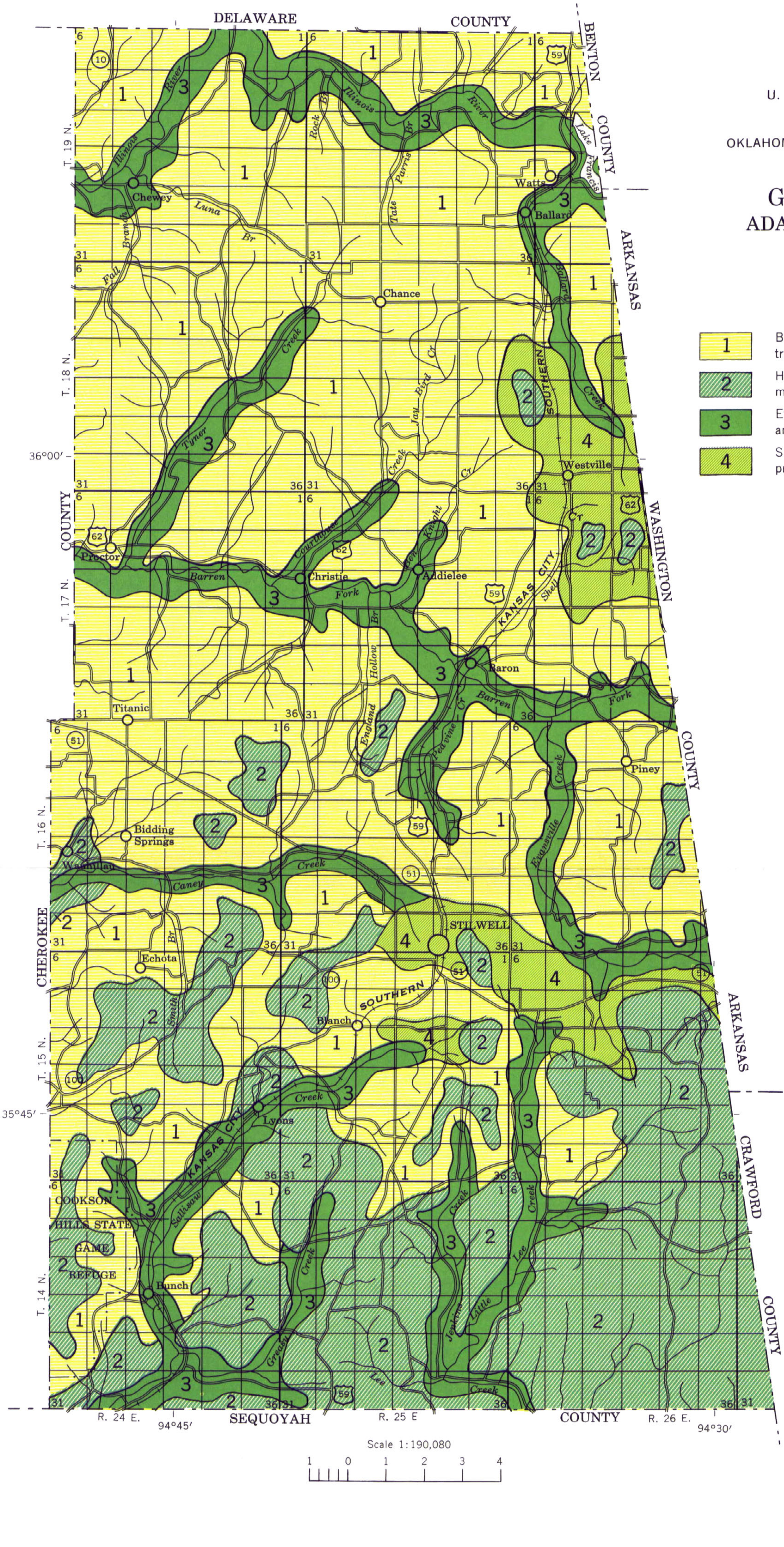


U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

OKLAHOMA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
ADAIR COUNTY, OKLAHOMA

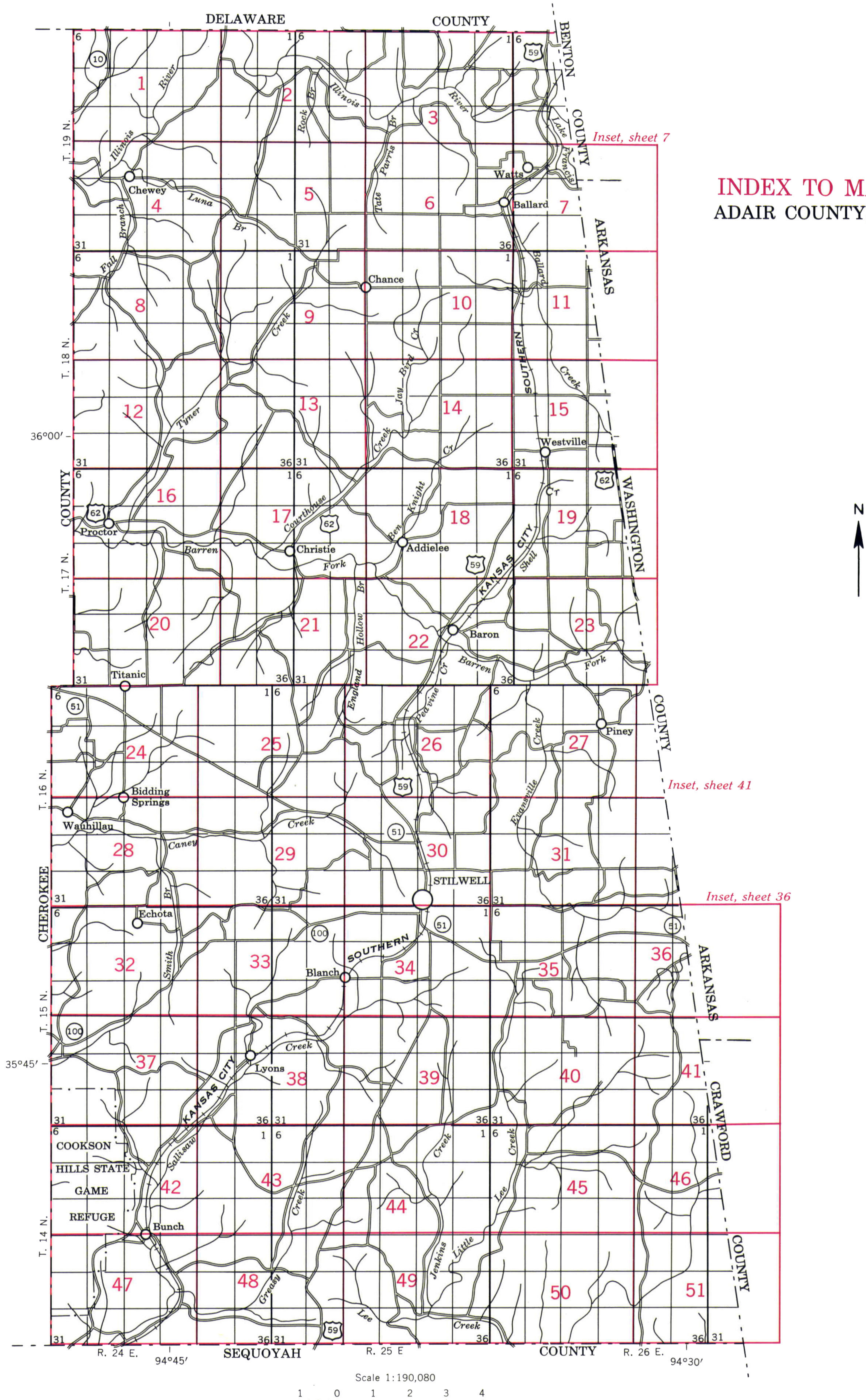
SOIL ASSOCIATIONS

- 1 — Bodine-Dickson association: Cherty soils formed under trees, on uplands
- 2 — Hector-Linker association: Soils on sandstone mountains
- 3 — Etowah-Huntington association: Soils on benches and flood plains
- 4 — Summit-Jay association: Soils formed under prairie grasses

September 1964

N

INDEX TO MAP SHEETS
ADAIR COUNTY, OKLAHOMA



SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, if used, shows the slope. Some symbols that do not contain a slope letter are for nearly level soils, such as Osage clay loam, but others, such as Sogn soils have a considerable range of slope. A final number 2, in the symbol shows that the soil is eroded.

SYMBOL	NAME
BdD	Bodine very cherty silt loam, 1 to 8 percent slopes
BoE	Bodine stony silt loam, 5 to 15 percent slopes
BsF	Bodine stony silt loam, steep
CrC	Craig cherty silt loam, 1 to 5 percent slopes
DcB	Dickson silt loam, 1 to 3 percent slopes
DkA	Dickson cherty silt loam, 0 to 3 percent slopes
EaA	Etowah silt loam, 0 to 1 percent slopes
EaB	Etowah silt loam, 1 to 3 percent slopes
EoB	Etowah gravelly silt loam, 1 to 3 percent slopes
EtD	Etowah and Greendale soils, 3 to 8 percent slopes
Ga	Gravelly alluvial land
Hc	Hector complex
HlC	Hector-Linker fine sandy loams, 1 to 5 percent slopes
Hn	Huntington silt loam
Hu	Huntington gravelly loam
JaA	Jay silt loam, 0 to 2 percent slopes
La	Lawrence silt loam
LkC	Linker fine sandy loam, 1 to 5 percent slopes
LkC2	Linker fine sandy loam, 3 to 5 percent slopes, eroded
LnC	Linker loam, 3 to 5 percent slopes
LnC2	Linker loam, 3 to 5 percent slopes, eroded
Oc	Osage clay loam
PaA	Parsons silt loam, 0 to 1 percent slopes
So	Sogn soils
SuA	Summit silty clay loam, 0 to 1 percent slopes
SuB	Summit silty clay loam, 1 to 3 percent slopes
SuC	Summit silty clay loam, 3 to 5 percent slopes
SuC2	Summit silty clay loam, 3 to 5 percent slopes, eroded
Ta	Taft silt loam
TkA	Taloka silt loam, 0 to 1 percent slopes

Soil map constructed 1964 by Cartographic Division, Soil Conservation Service, USDA, from 1958 aerial photographs. Controlled mosaic based on Oklahoma plane coordinate system, north zone, Lambert conformal conic projection. 1927 North American datum.

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Dual
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail, foot
- Railroad
- Ferries
- Ford
- Grade
- R. R. over
- R. R. under
- Tunnel

Buildings
- School
- Church
- Station

Mines and Quarries
- Mine dump
- Pits, gravel or other

Power lines

Pipe lines

Cemeteries

Dams

Levees

Tanks

Oil wells

BOUNDARIES

- National or state
- County
- Township, U. S.
- Section line, corner
- Reservation

DRAINAGE

Streams
- Perennial
- Intermittent, unclass.

Canals and ditches — CANAL, DITCH

Lakes and ponds
- Perennial
- Intermittent

Wells — flowing

Springs

Marsh

Wet spot

Alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Prominent peaks

Depressions — Large, Small
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

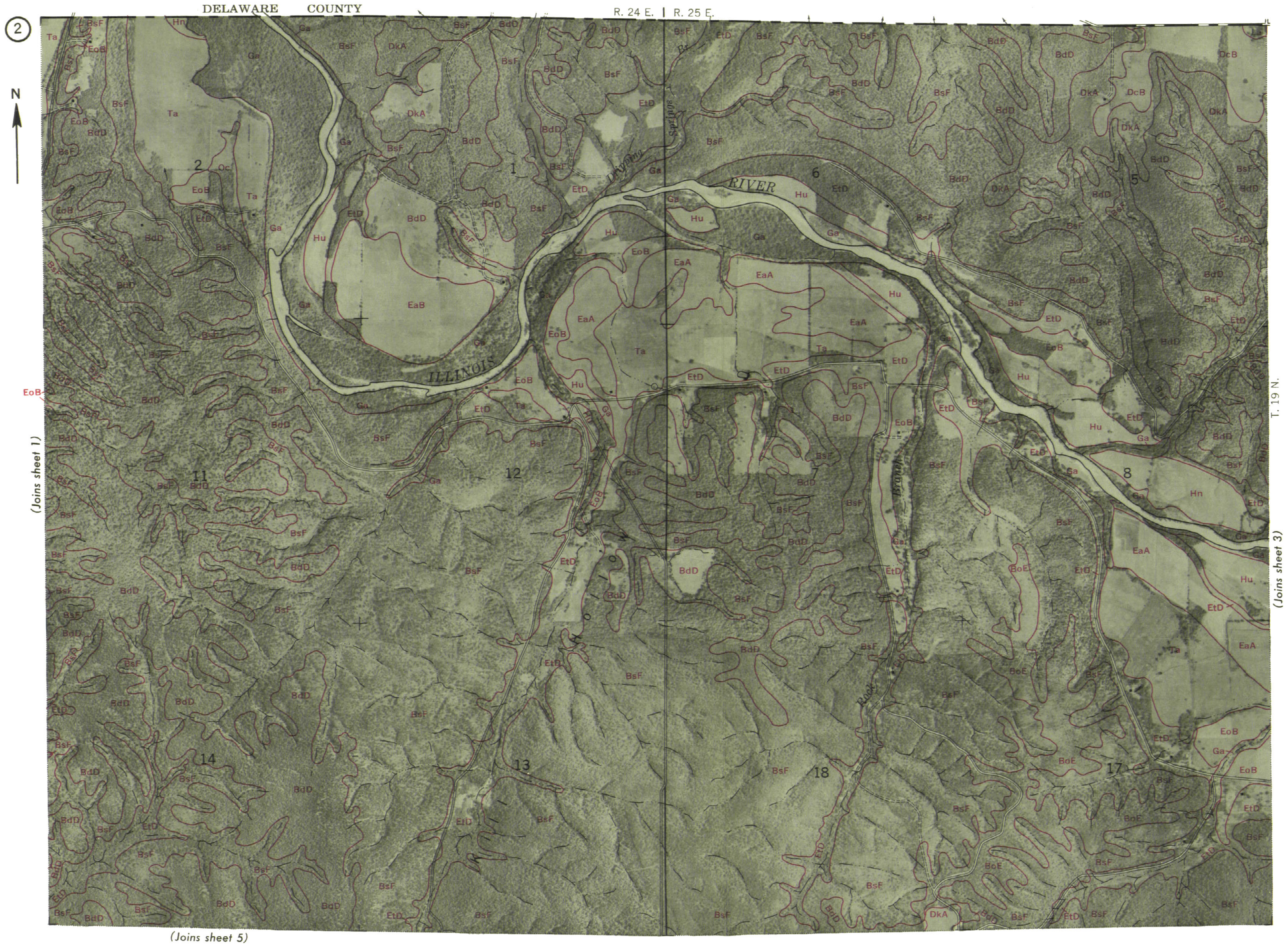
- Soil boundary and symbol — Dx
- Gravel
- Stones
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land
- Severely eroded spot
- Blowout, wind erosion
- Gullies

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 1

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet



0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 3

0 ½ 1 Mile Scale 1:20 000 0 5000 Feet

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ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 4

(4)

(Joins sheet 1)

R. 24 E.

N

(Joins sheet 5)

(Joins sheet 8)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 5

5

N

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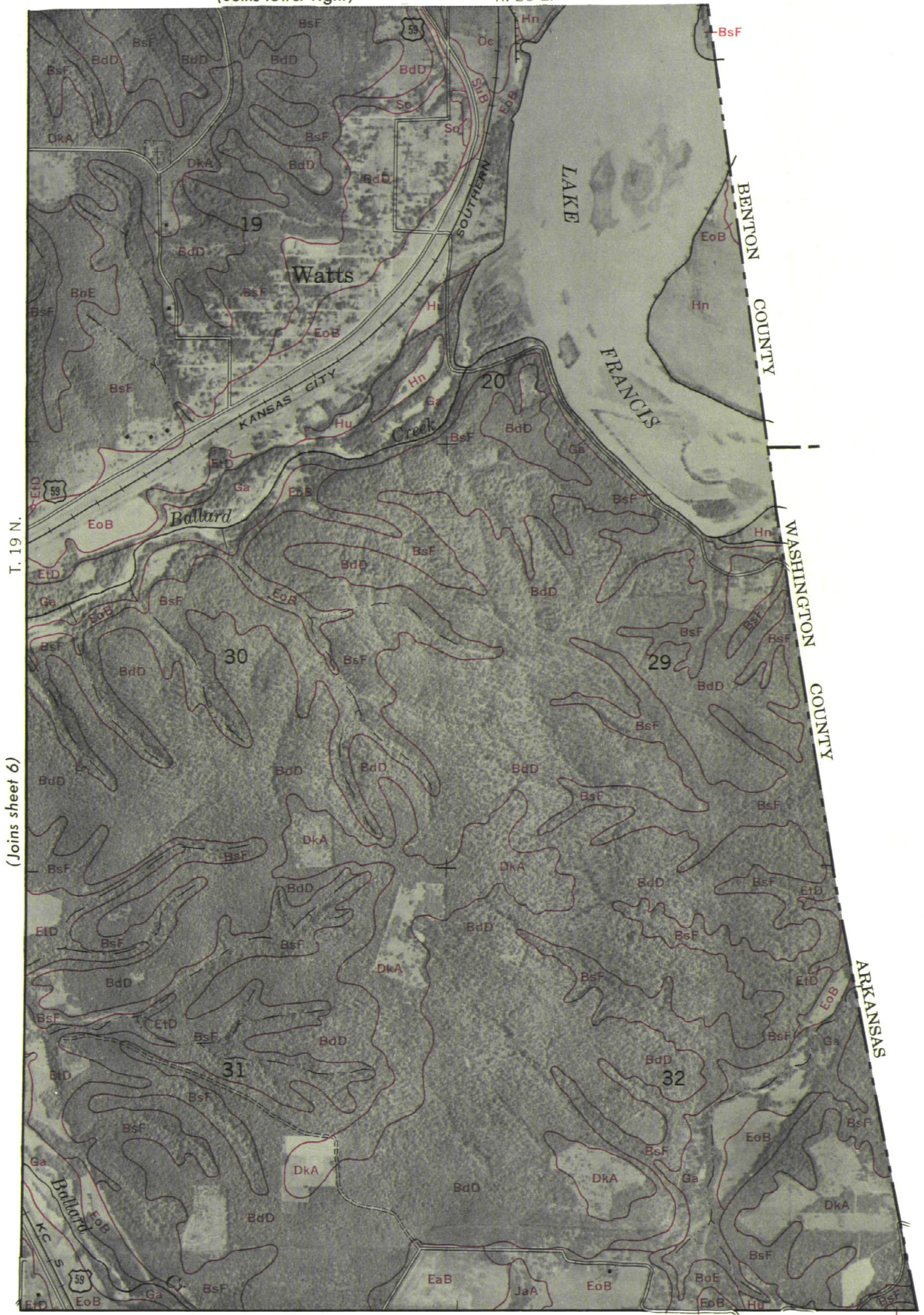
0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 6

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

7

N



0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

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8

(Joins sheet 4)

R. 24 E.

N

CHEROKEE COUNTY

T. 18 N.

(Joins sheet 9)

(Joins sheet 12)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 9

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

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ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 10

10

(Joins sheet 6)

R. 25 E.

T. 18 N.

(Joins sheet 9)

(Joins sheet 11)

(Joins sheet 14)

BdD

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

11

N

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

12

(Joins sheet 8)

R. 24 E.

CHEROKEE COUNTY

T. 18 N.

(Joins sheet 13)

(Joins sheet 16)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

(Joins sheet 9)

(Joins sheet 12)

(Joins sheet 14)

(Joins sheet 17)

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

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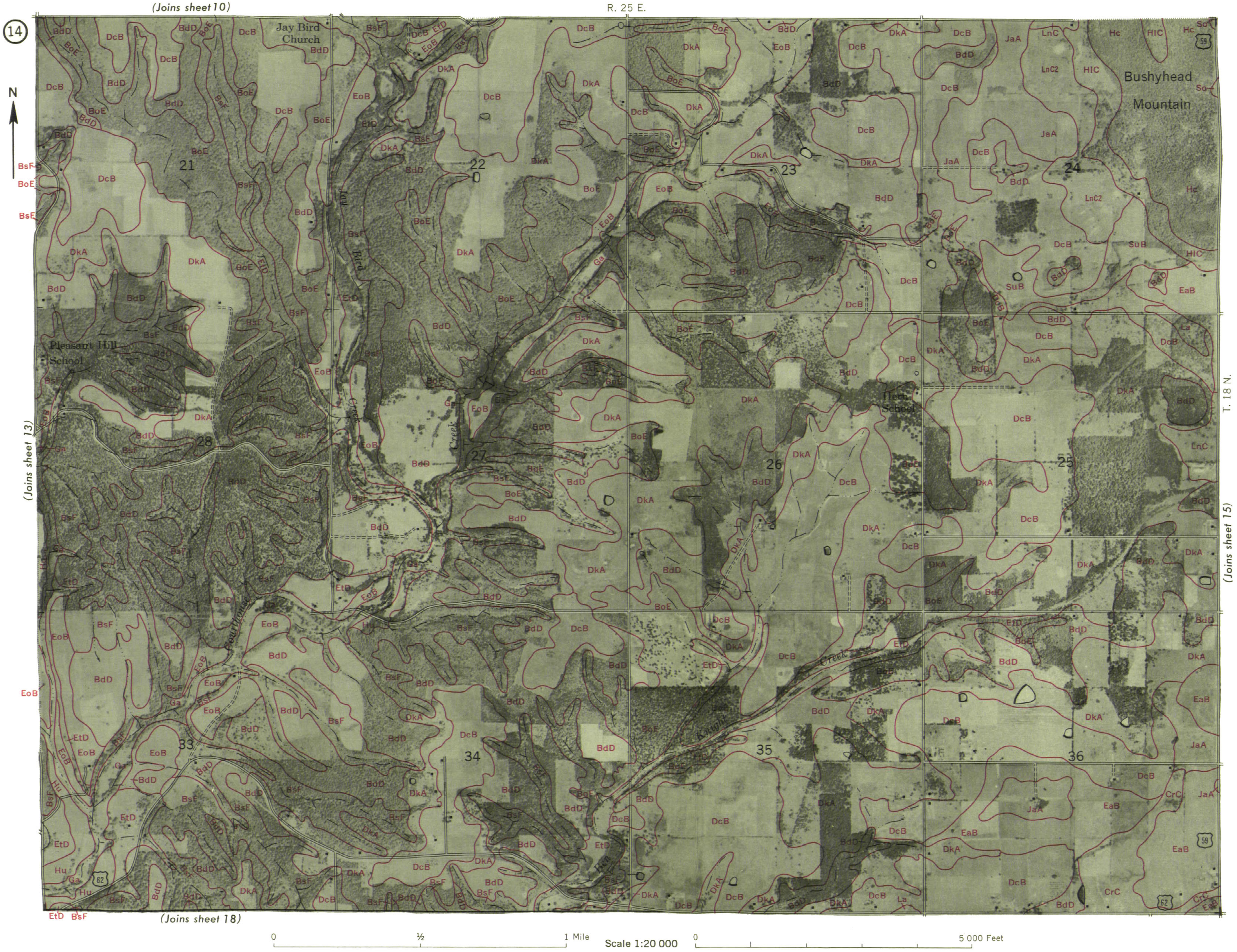

14
(Joins sheet 10)
R. 25 E.
N
Jay Bird Church
Bushyhead Mountain
Pleasant Hill School
T. 18 N.
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 18)
21
22
23
24
28
27
26
25
33
34
35
36
0
½
1 Mile
Scale 1:20 000
0
5 000 Feet

0 ½ 1 Mile
Scale 1:20 000
0 5 000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

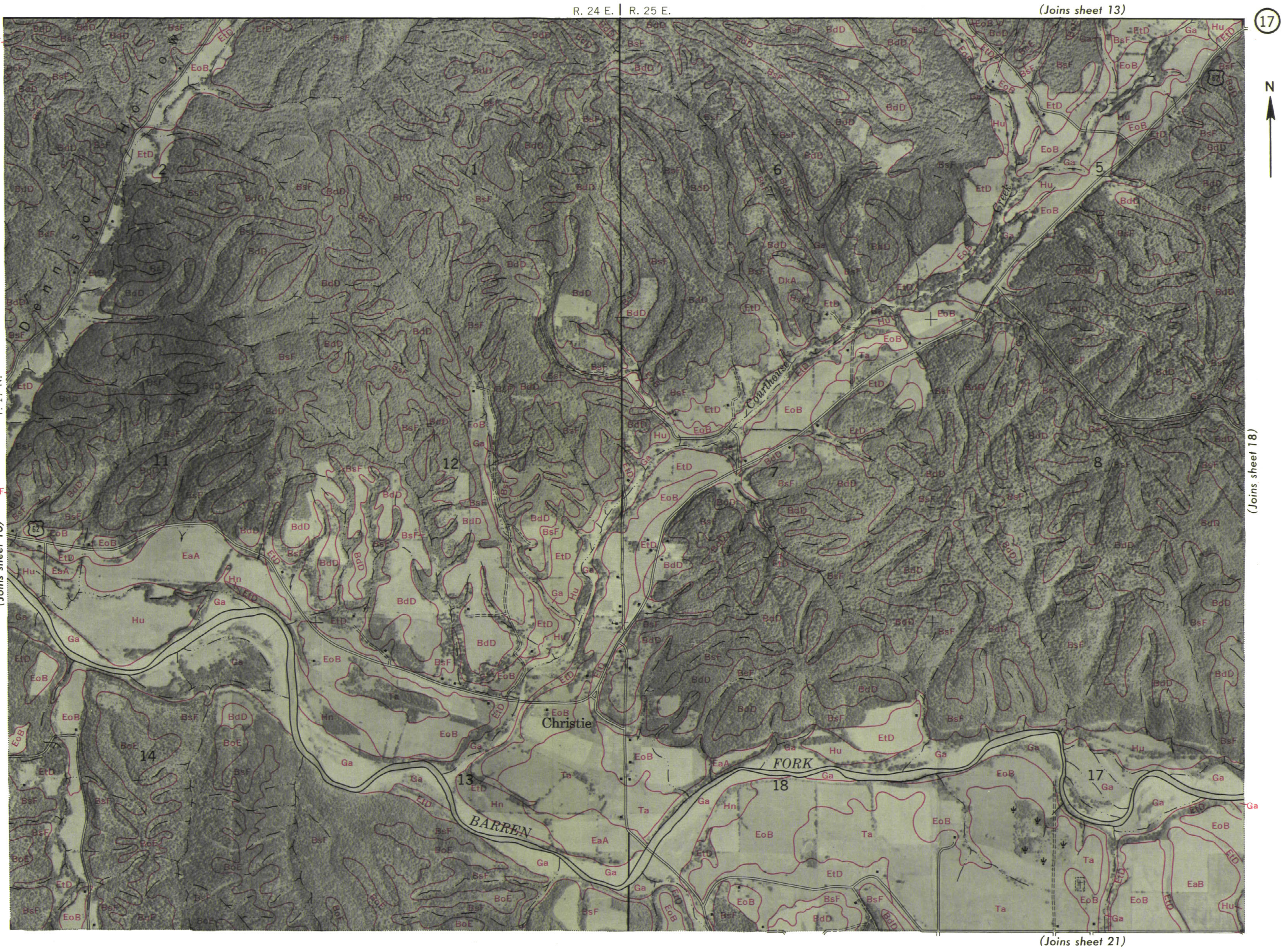
(Joins sheet 12)

(Joins sheet 20)

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ 1 Mile

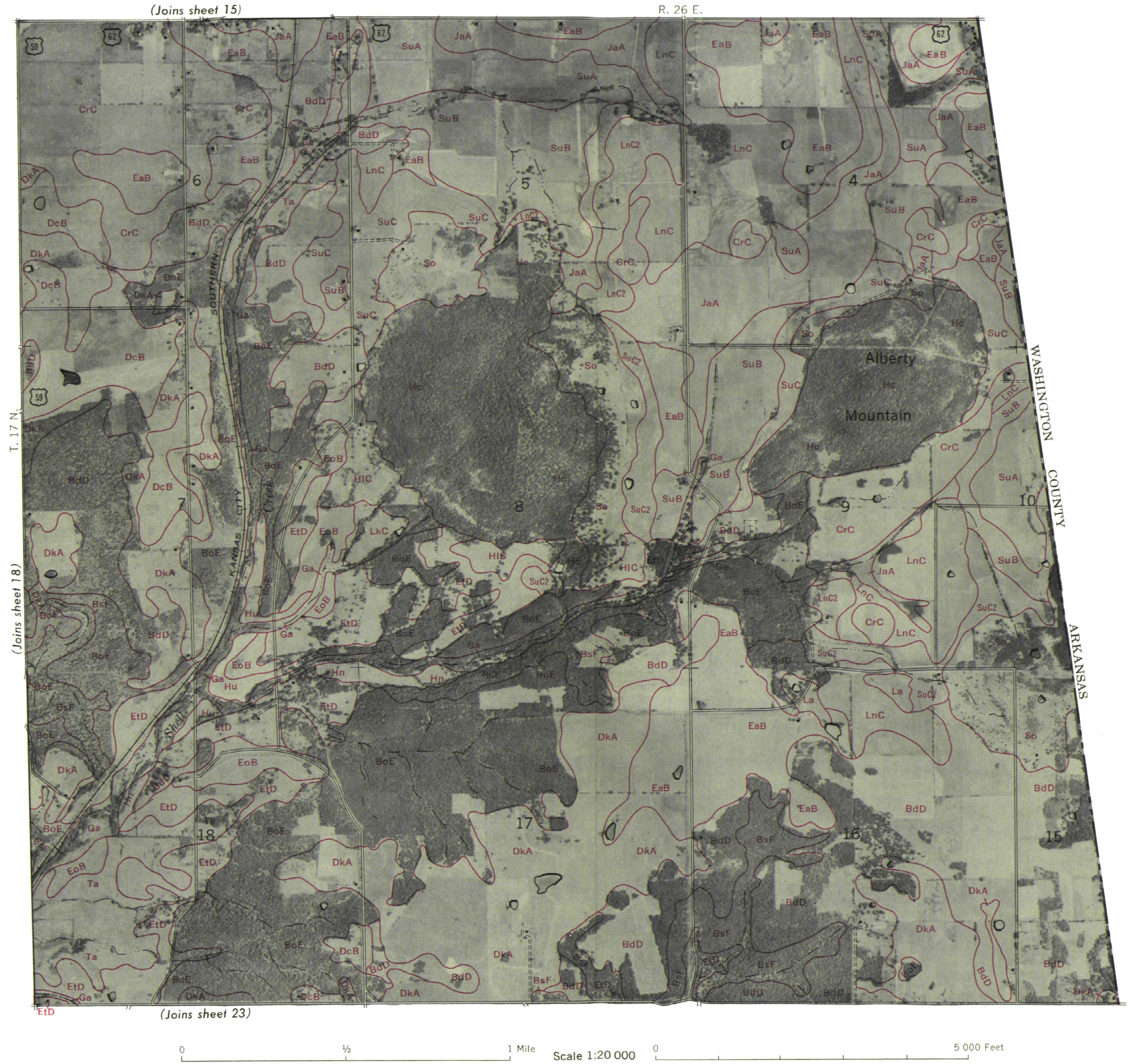
Scale 1:20 000

0 5 000 Feet

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 20

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 22

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

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Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 24

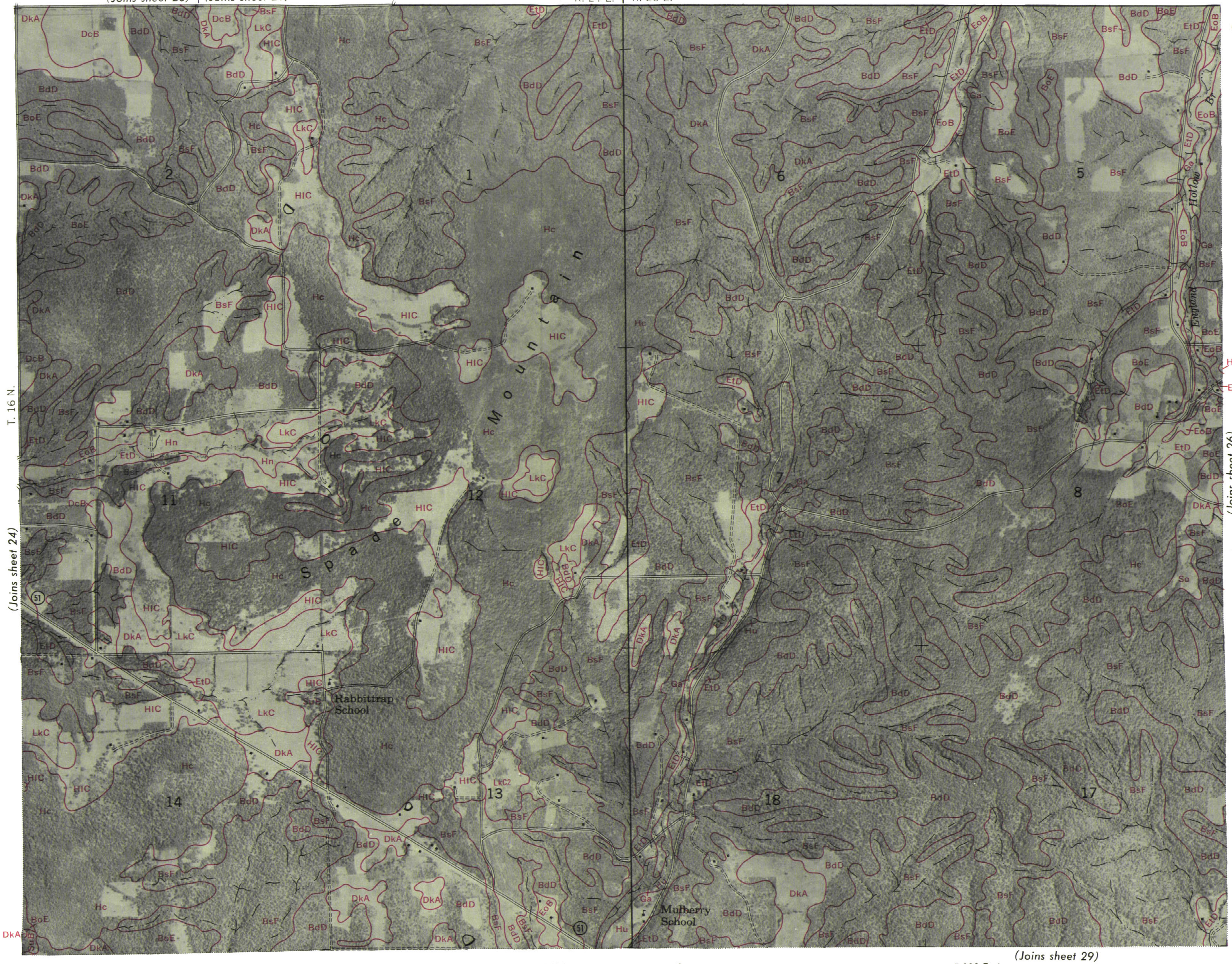
0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 25

(Joins sheet 20) | (Joins sheet 21)

R. 24 E. | R. 25 E.

25



(Joins sheet 24)

(Joins sheet 26)

(Joins sheet 29)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 26

Scale 1:20 000

0 ½ 1 Mile

0 5 000 Feet

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 27

(Joins sheet 22) | (Joins sheet 23)

R. 26 E.

27

(Joins sheet 26)

(Joins inset, sheet 41)

(Joins sheet 31)

N

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

28

(Joins sheet 24)

R. 24 E.

CHEROKEE COUNTY

T. 16 N.

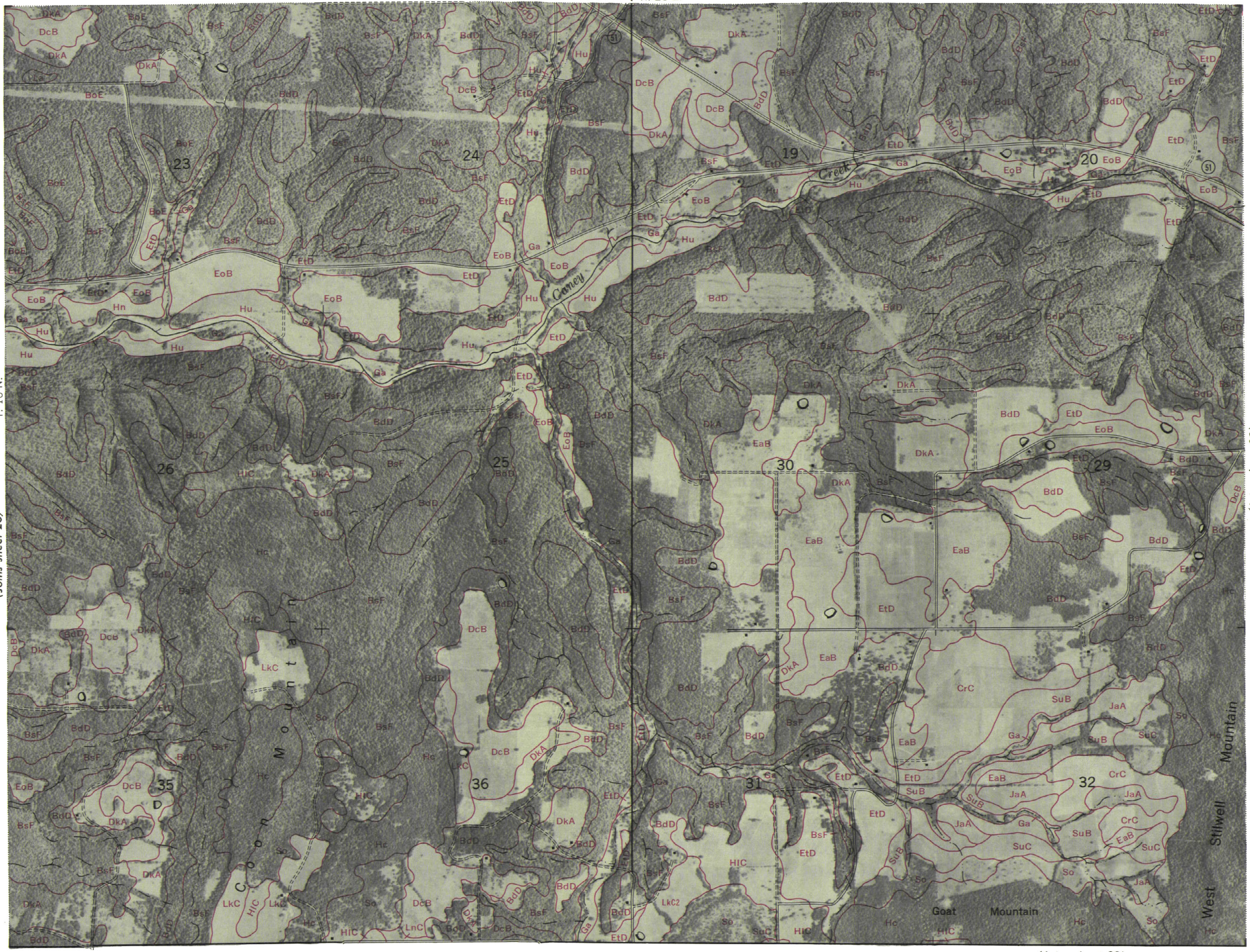
(Joins sheet 29)

(Joins sheet 32)

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 29

(Joins sheet 25)



(Joins sheet 28)

(Joins sheet 30)

(Joins sheet 33)

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

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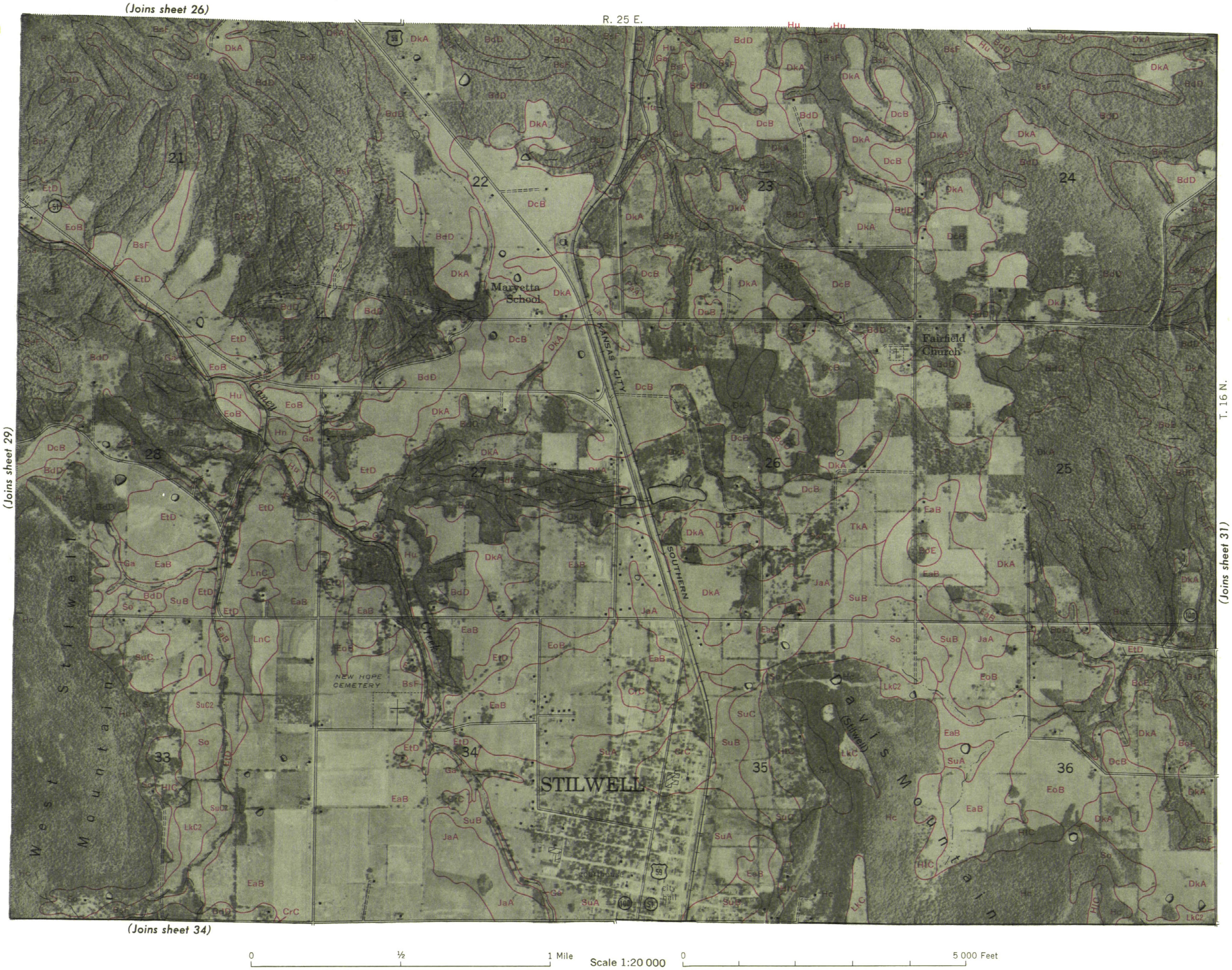
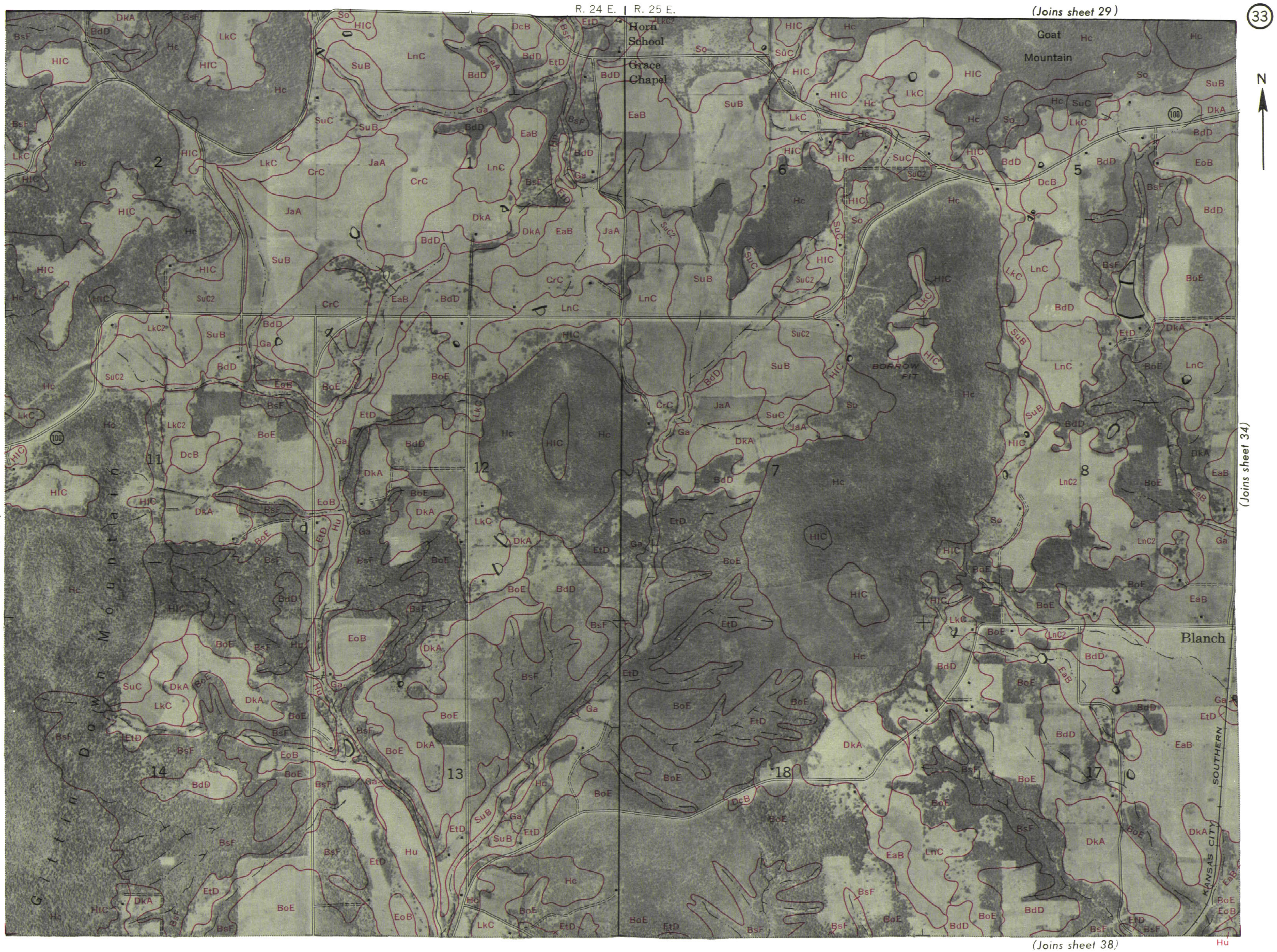

30
(Joins sheet 26)
R. 25 E.
N
(Joins sheet 29)
T. 16 N.
(Joins sheet 31)
(Joins sheet 34)
Marvetta School
Fairfield Church
KANSAS CITY
SOUTHERN
Caney
Creek
NEW HOPE CEMETERY
STILWELL
City Hall
West Stilwell Mountain
Davis Mountain
(Stilwell)
21
22
23
24
25
26
27
28
33
34
35
36
0
½
1 Mile
Scale 1:20 000
0
5 000 Feet

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.


32
N
(Joins sheet 28)
R. 24 E.
T. 15 N.
(Joins sheet 33)
(Joins sheet 37)
CHEROKEE COUNTY
Rocky Mountain School
Echota
Jakes Creek
Smith Branch
HUNGRY MOUNTAIN
Jackson Mountain
Gittin Down Mountain
3
4
5
6
7
8
9
10
15
16
17
18
100
0
½
1 Mile
Scale 1:20 000
0
5 000 Feet

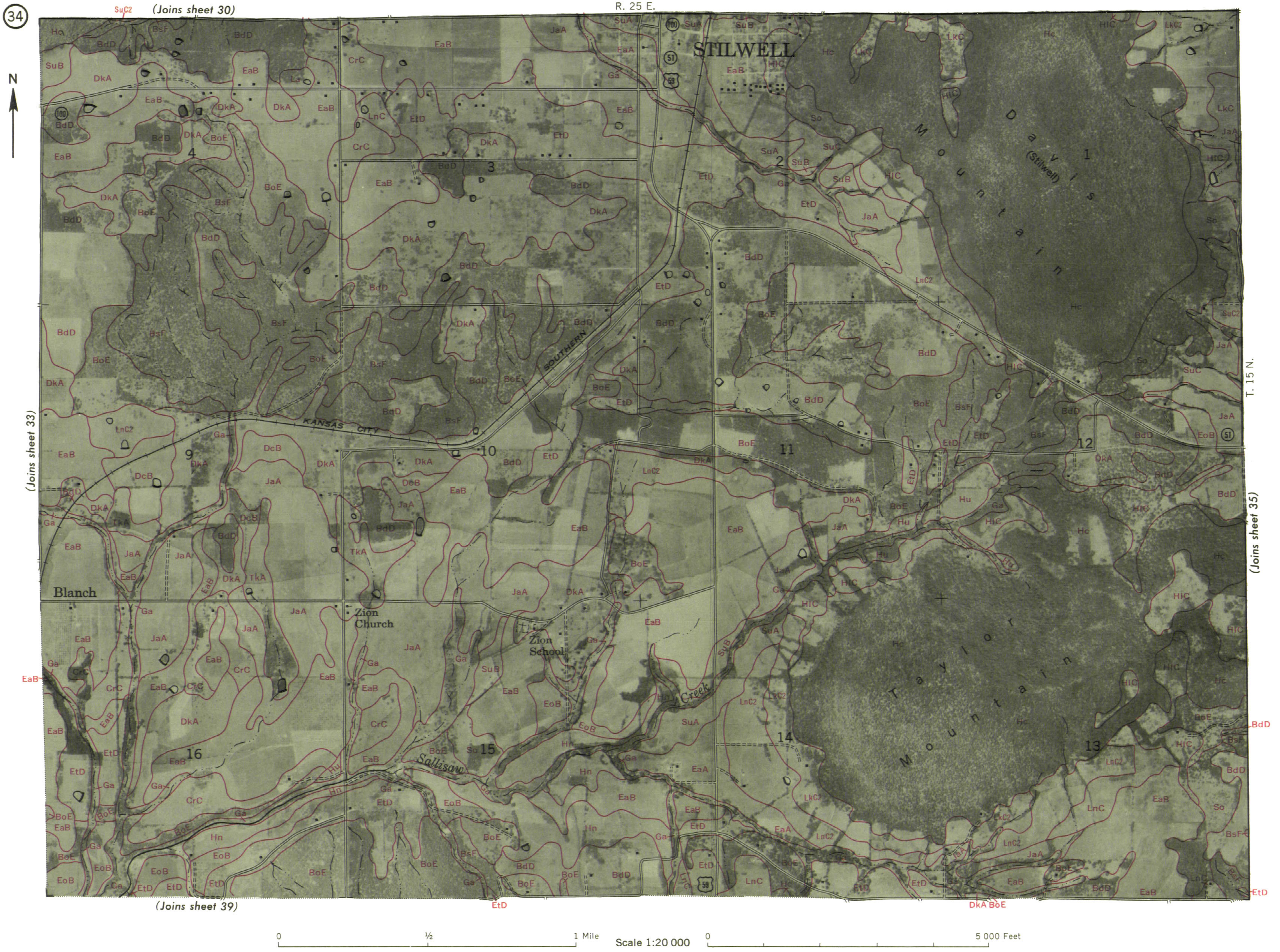


This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 34



35

R. 26 E.

(Joins sheet 31)

(Joins sheet 34)

(Joins sheet 36)

(Joins sheet 40)

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite

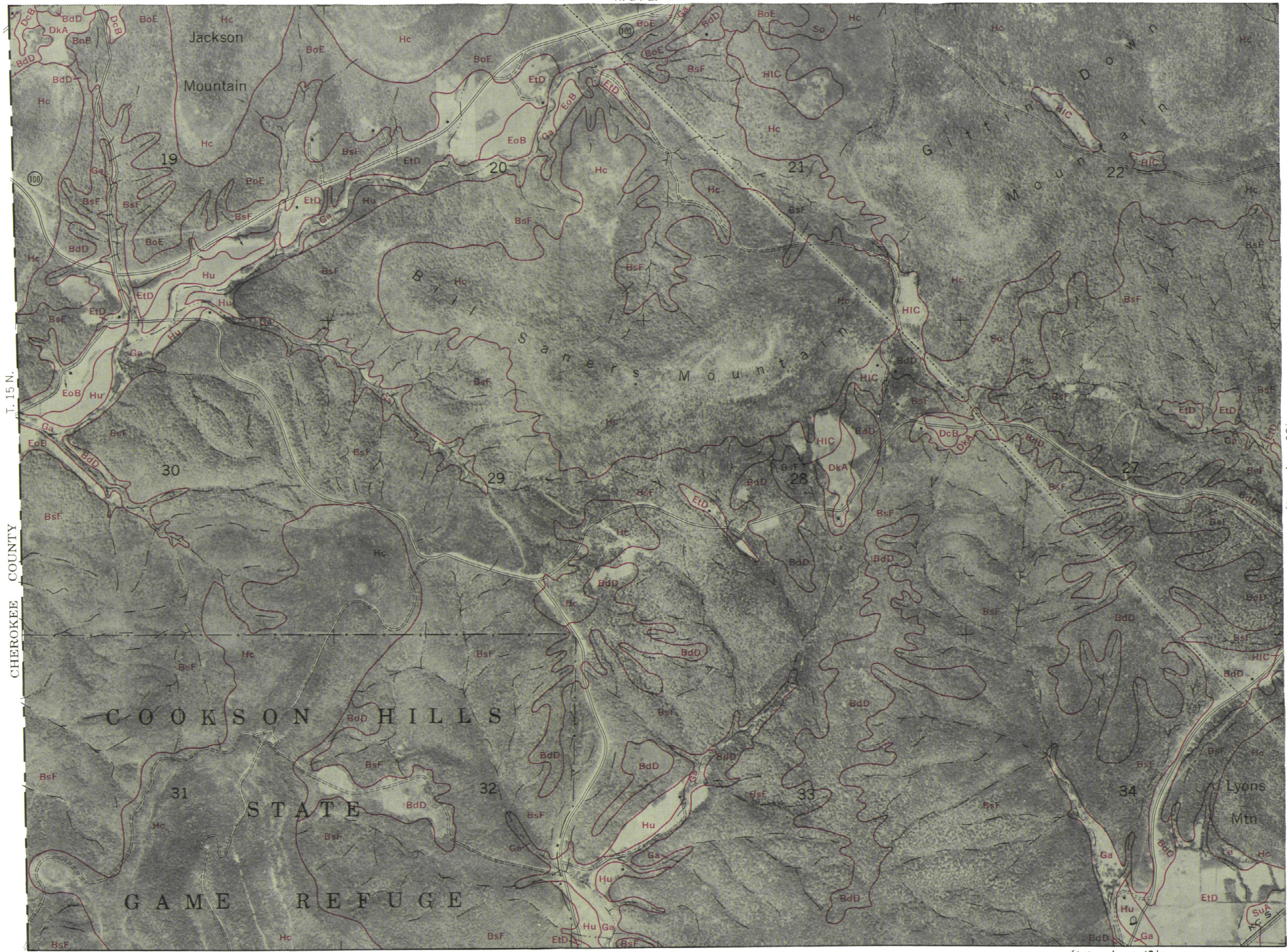
0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

(Joins sheet 32)



(Joins sheet 42)

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.

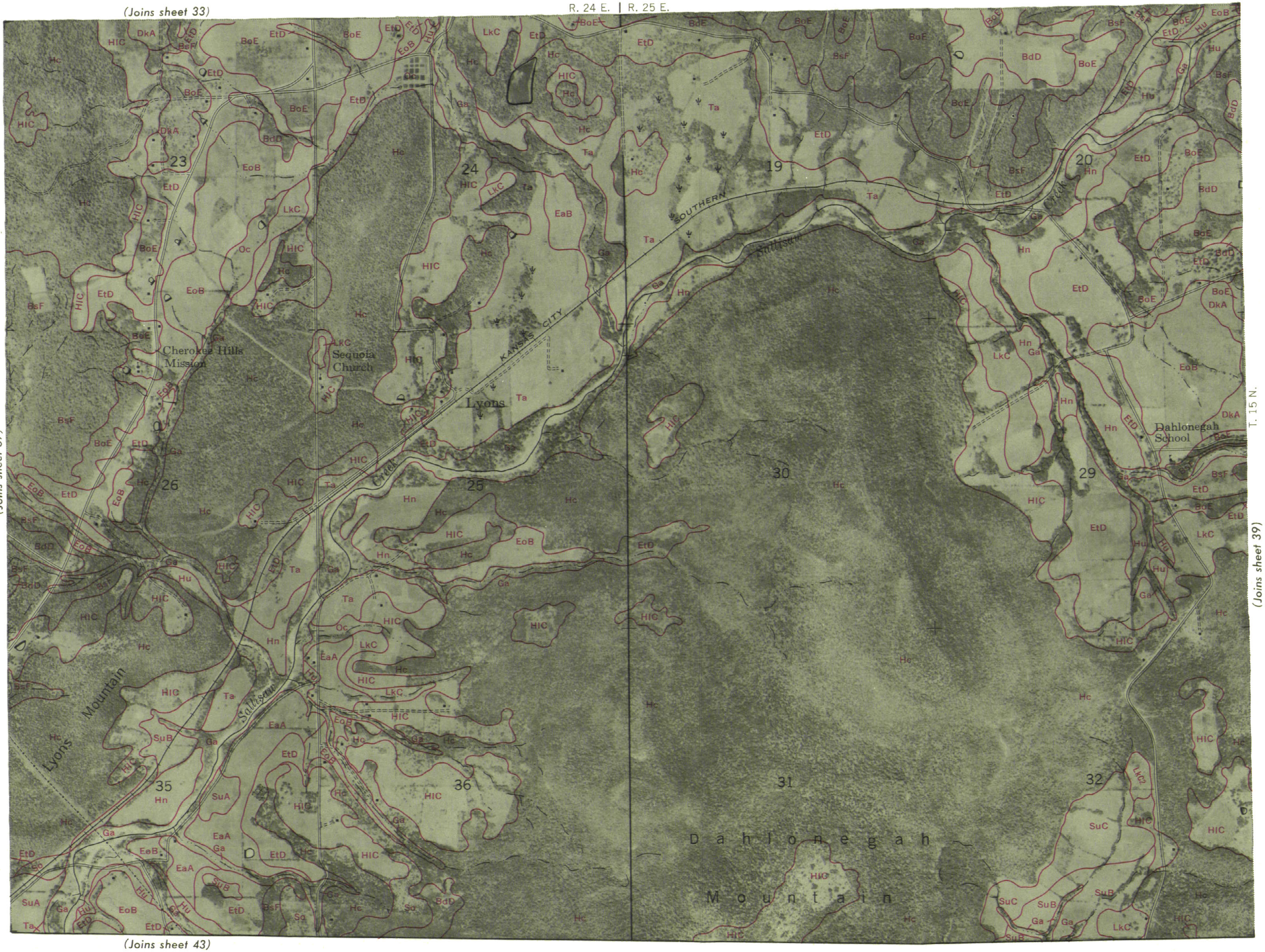
38

(Joins sheet 33)

R. 24 E. | R. 25 E.

N

(Joins sheet 37)



T. 15 N.

(Joins sheet 39)

(Joins sheet 43)

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

39

R. 25 E.

(Joins sheet 34)

T. 15 N.

(Joins sheet 38)

N

(Joins sheet 40)

(Joins sheet 44)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

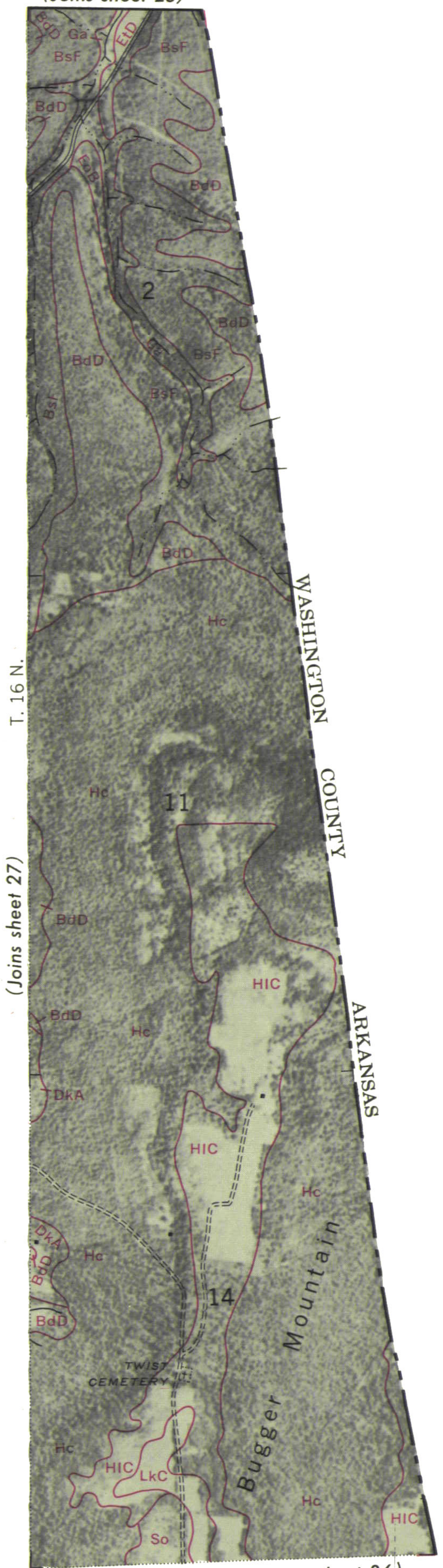
This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.


40
(Joins sheet 35)
R. 26 E.
N
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 45)
T. 15 N.
19
20
21
22
29
28
27
30
31
32
33
34
Muskrat Mountain
Little Lee Creek
Bell School
0
½
1 Mile
Scale 1:20 000
0
5 000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

42

(Joins sheet 37)

R. 24 E.

N

CHEROKEE COUNTY

T. 14 N.

(Joins sheet 43)

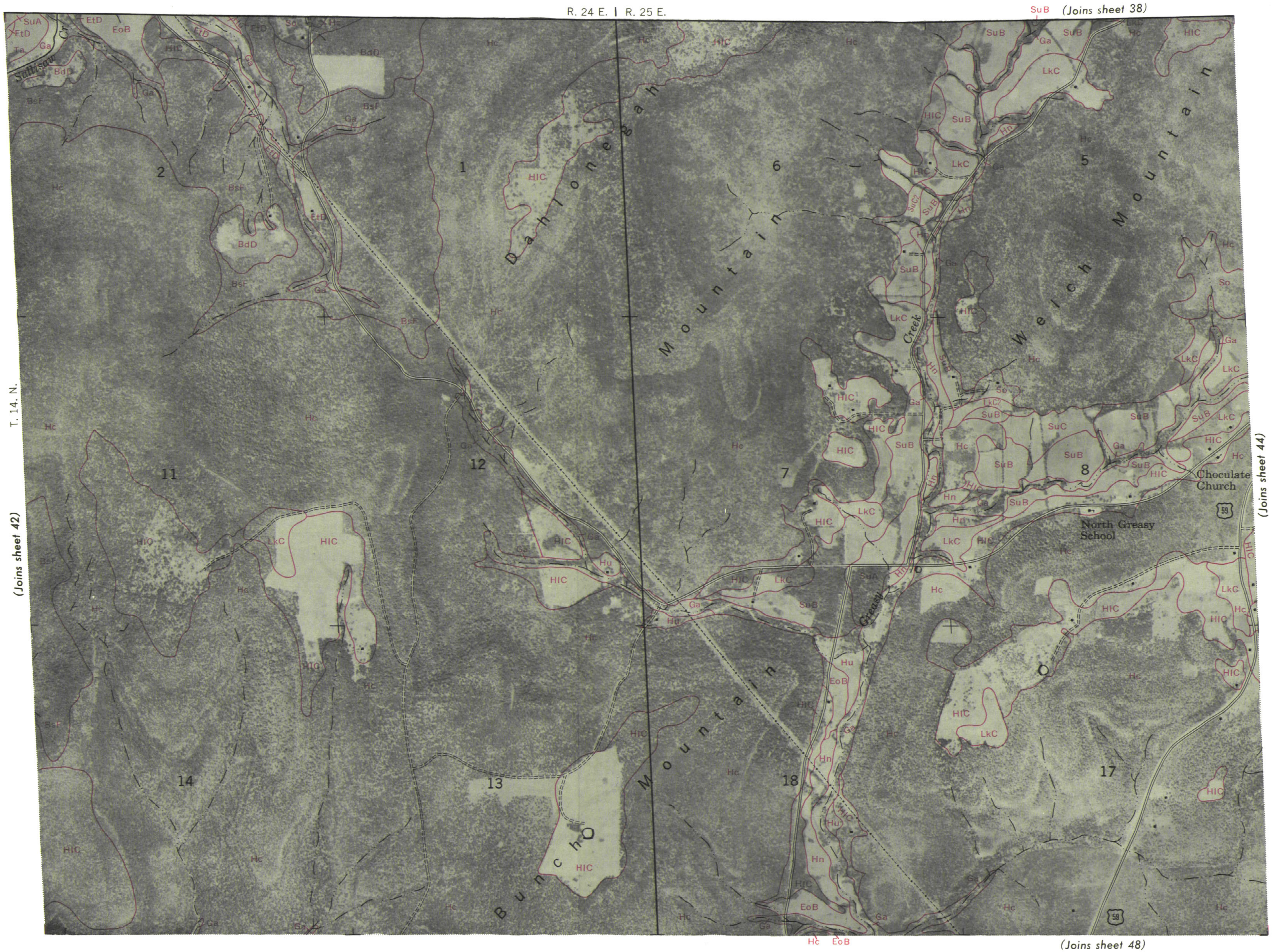
(Joins sheet 47)

0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

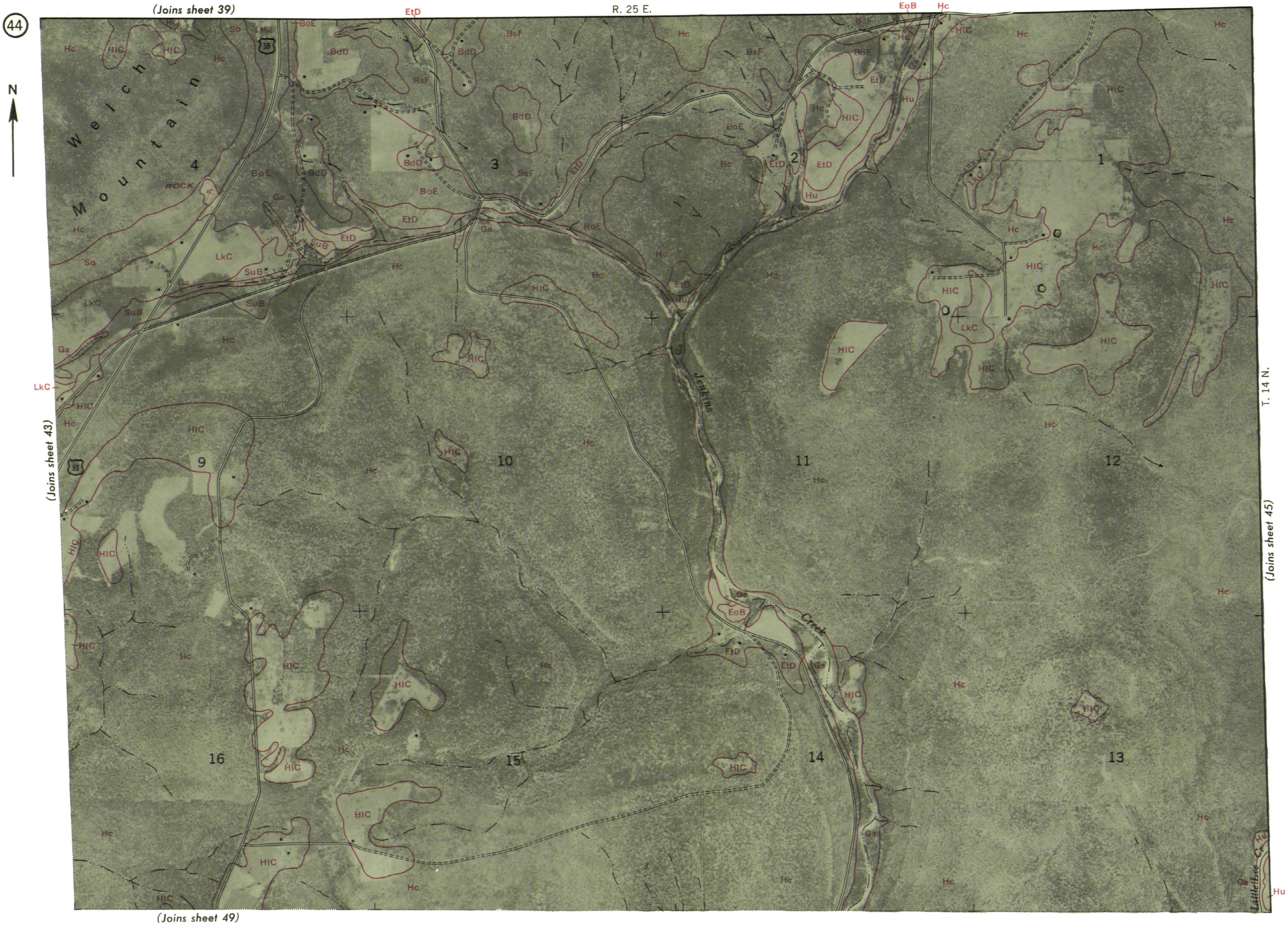
43



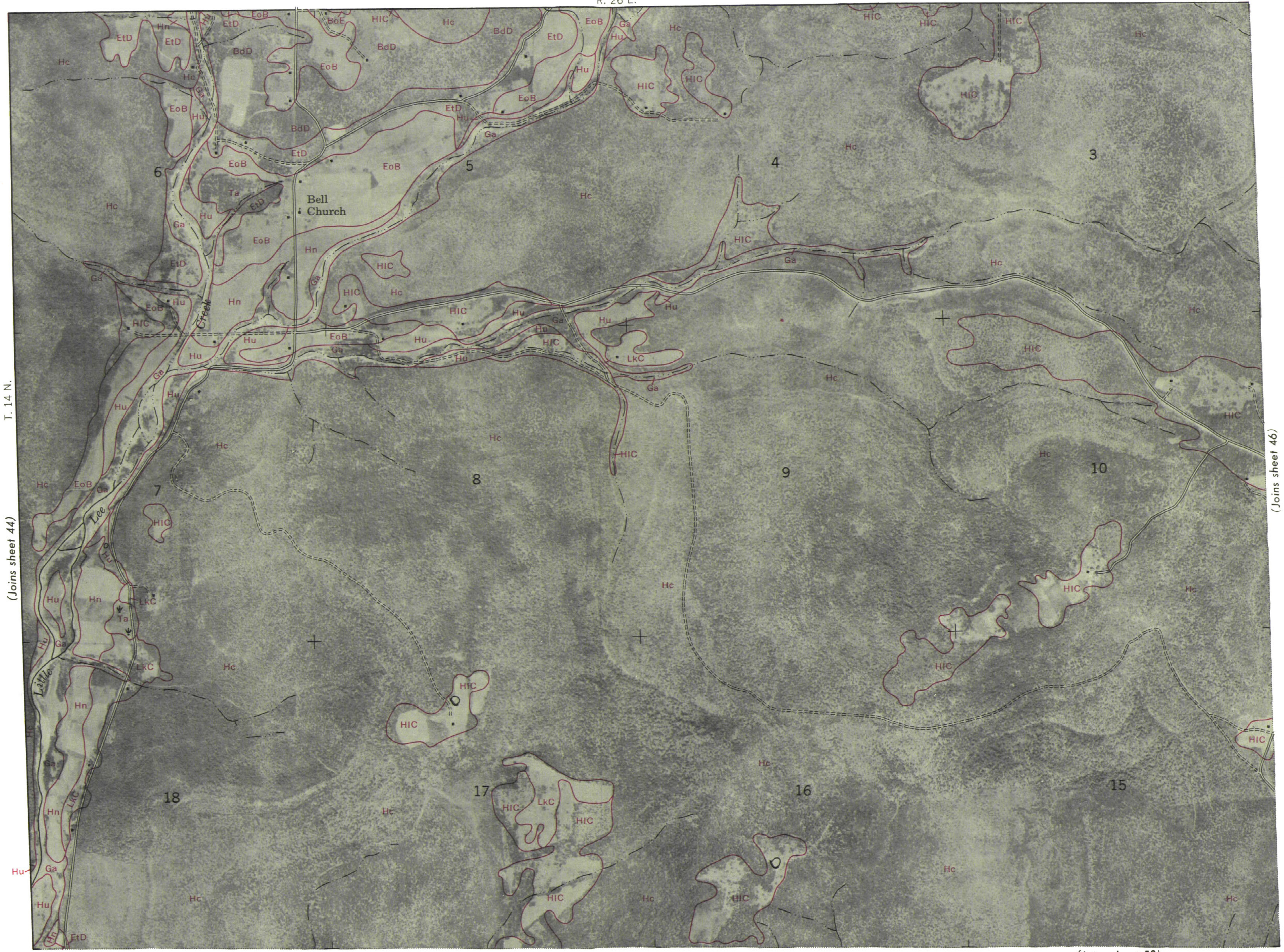
0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.



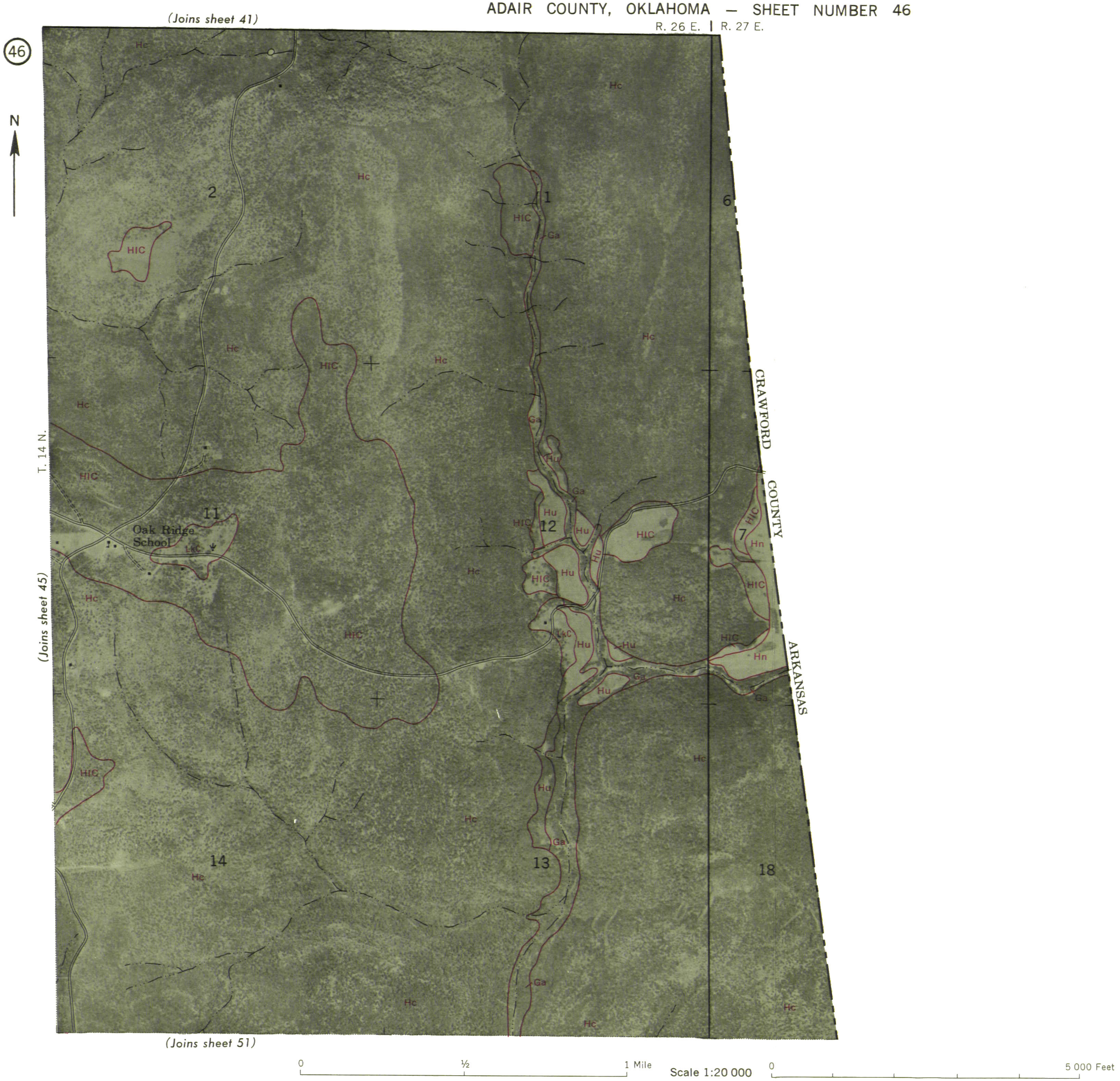
0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

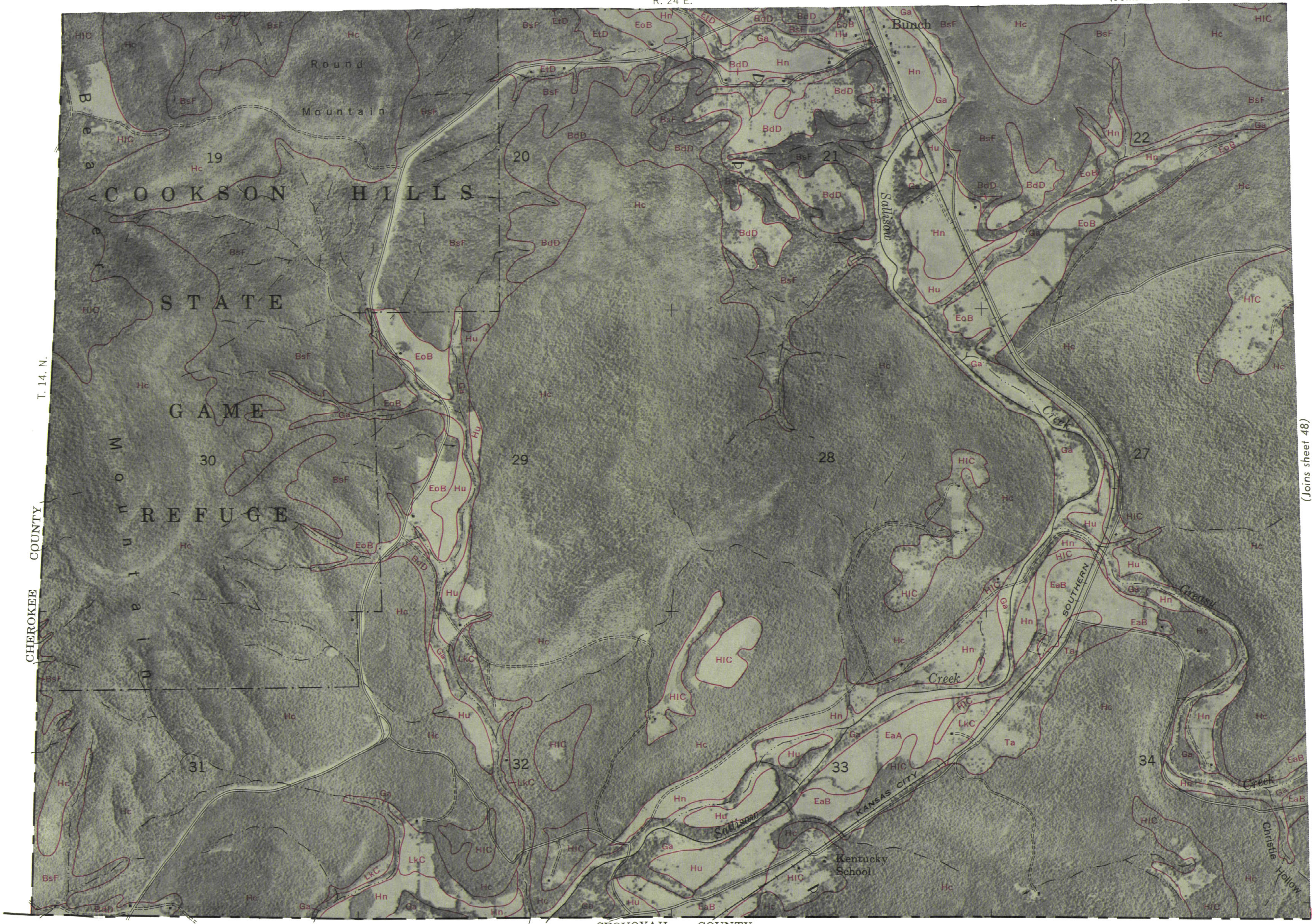


0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

Range, township, and section corners shown on this map are indefinite.


(Joins sheet 41)
R. 26 E. | R. 27 E.
46
N
T. 14 N.
(Joins sheet 45)
(Joins sheet 51)
CRAWFORD COUNTY
ARKANSAS
Oak Ridge School
2
1
6
11
12
7
14
13
18
Hc
HlC
Ga
Hu
Hn
LkC
0 ½ 1 Mile
Scale 1:20 000
0 5 000 Feet



This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

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0 ½ 1 Mile

Scale 1:20 000

0 5 000 Feet

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 48

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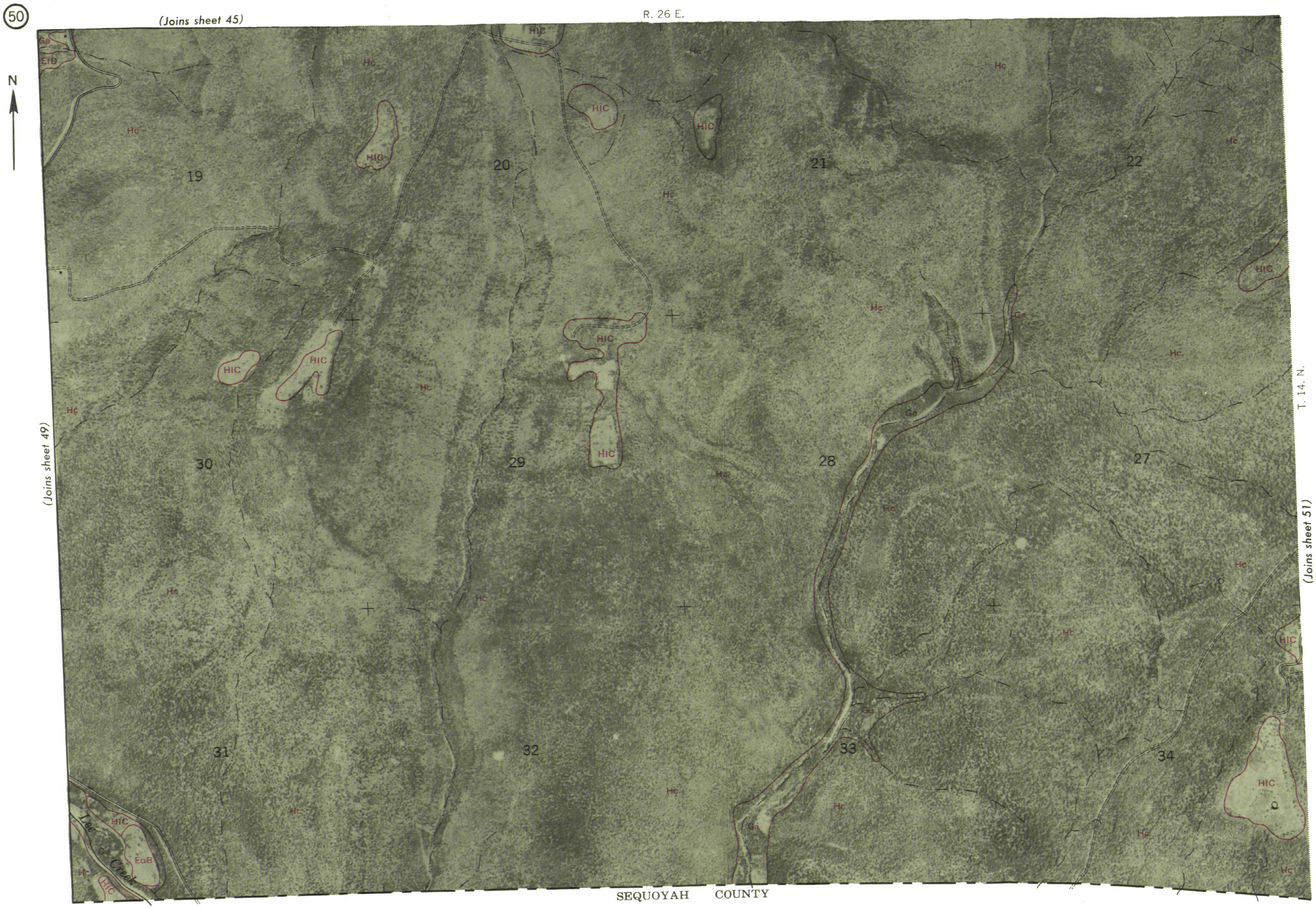
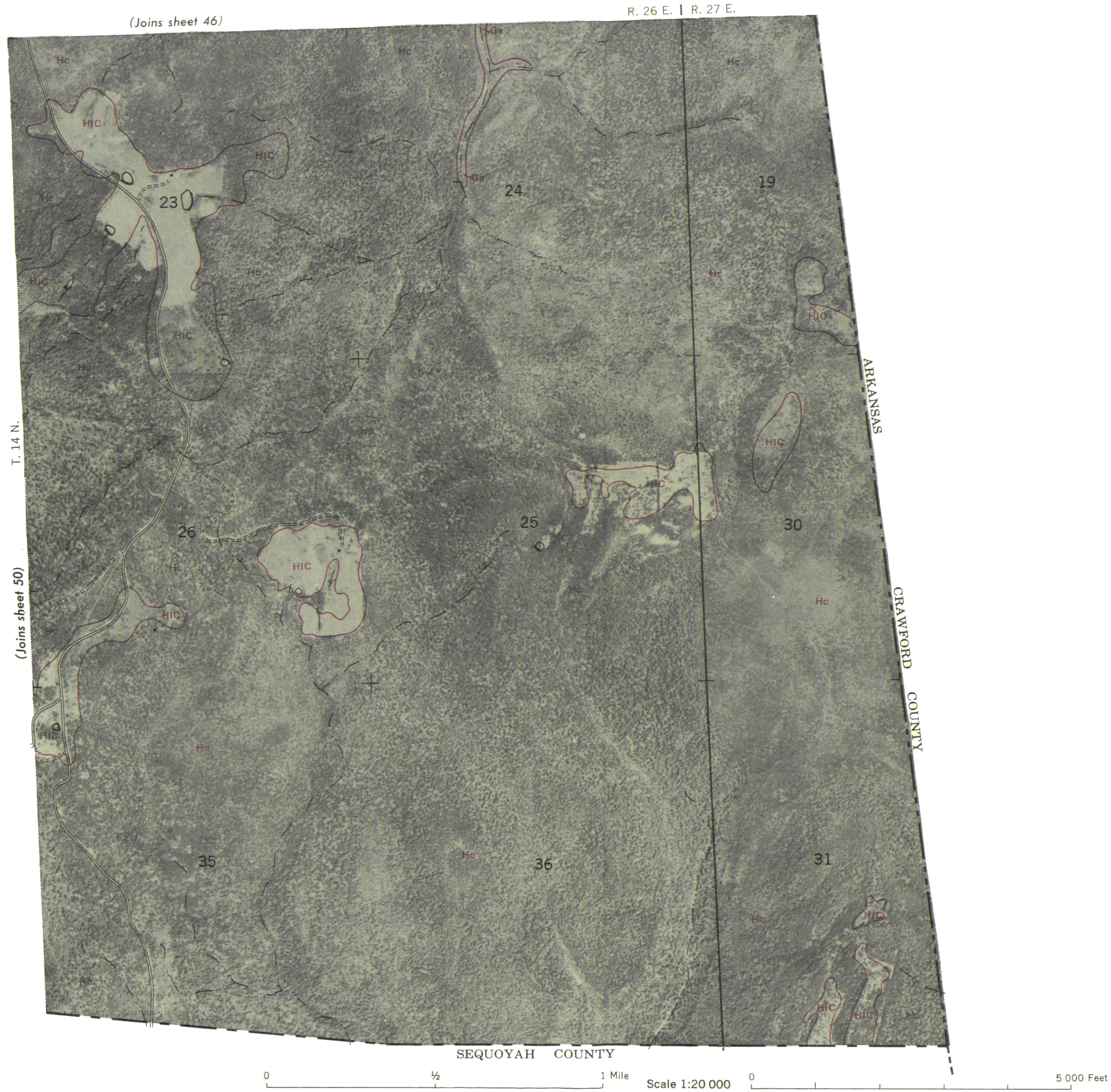
Range, township, and section corners shown on this map are indefinite.

0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet

ADAIR COUNTY, OKLAHOMA — SHEET NUMBER 50



0 ½ 1 Mile Scale 1:20 000 0 5 000 Feet



N

This map is one of a set compiled in 1964 as part of a soil survey by the Soil Conservation Service, United States Department of Agriculture, and the Oklahoma Agricultural Experiment Station.

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